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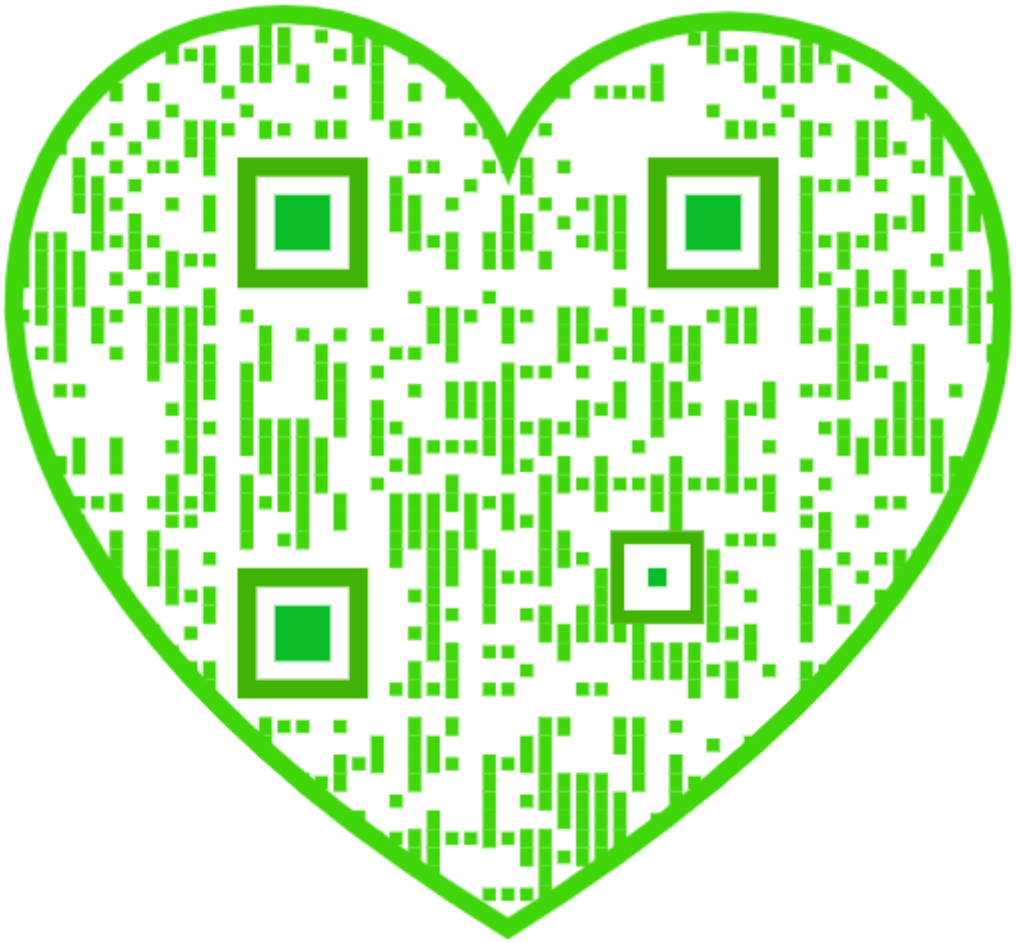

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DENTAL FORMULARY

A Practical Guide for the Preparation of Chemical and Technical Compounds and Accessories as Used in the Office and Laboratory by the Dental Practitioner

WITH

An Index to Oral Diseases and Their Treatment

BY

HERMANN PRINZ, M. D., D. D. S.

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Second Edition, Revised and Rewritten

PITTSBURGH, PA.
LEE S. SMITH & SON CO.
1911

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Preamble

The lecturer must not be the ant, collecting all things indiscriminately from all quarters, as provender for his discourses:

Nor the spider, seeking no materials abroad, but spinning his web of speculative doctrine from within himself;

But rather the bee, extracting crude honey from various flowers, storing it up in the recesses of his brain, and submitting it to the operation of his internal faculties, until it be matured and ready for use.

LORD BACON.

PREFACE TO THE SECOND EDITION.

The reception given to the first edition of the Dental Formulary was most gratifying, not only in this country but also in the remainder of the English speaking world. The issue practically became exhausted within a few months. Owing to many duties, the second edition has been delayed for some time.

The text for the new edition of the Dental Formulary has been completely rewritten; many important additions have been made, especially in regard to recent improvements concerning the preparation of investment compounds, impression waxes, and other materials used in the construction of metallic inlays. Some of the matter which has become obsolete has been discarded. A number of recipes has been modified according to present needs, and many tests have been carried out to verify the composition and construction of formulas. Only such formulas are presented which have shown to possess real merit and to be worthy of an extended trial at the hands of the profession. An earnest effort has been made to present the whole matter in a thoroughly up-to-date manner.

The author wishes to thank his many professional friends who have assisted him most generously in the preparation of the second edition of the Dental Formulary.

H. P.

Washington University Dental School.
St. Louis, Mo., August, 1911.

FROM THE PREFACE TO THE FIRST EDITION.

The many inquiries regarding formulas for technical and chemical compounds, or special methods of procedure relative to the treatment of oral diseases, received from dental practitioners, has been the prime incentive to the preparation of this volume.

Its object is to furnish the practitioner and student with a reliable guide of technical information as needed in the office and laboratory of a busy practice. No claim of originality is made for all the recipes and formulas—such complexity is rarely the product of a single brain. Due credit has been given wherever originality could be clearly established. The matter has been gleaned from English, German and French current literature and other sources.

The author has carefully selected, modified when necessary, and in the majority of cases made tests to establish reliability. Each formula as represented in this work may be simply regarded as a basis; it may be employed as such or modified to suit the conditions at hand. In general, however, it should be remembered that most of these formulas represent the practical results of mature minds who are known as experts in their specific branches. Formulas, recipes, and special processes as published in the dental journals, and even in text books, are frequently selected at random without due consideration of their practicability or their trustworthiness; they often contain mistakes which naturally produce unreliable and, under certain conditions, dangerous results.

The book is primarily intended to be a practical guide, consequently all scientific theories or matters of controversy have been purposely omitted. While the author feels he has covered a wide field, yet he is aware of the fact that the book is of necessity incomplete in many respects. This, however, may be expected of any work of its size and nature.

For most of the illustrations the author is indebted to his friend and former pupil, Dr. Jas. A. Brown, who has greatly assisted him in the preparation of this and other matters. The author further wishes to thank his many friends who by their assistance have been of much help to him.

Whether a book of the nature of a dental formulary is needed by the English speaking practitioner, the future has to decide. Similar works published in German and in French have been successful. It is the intention of the author to continue the task before him, keeping the book up to date by constantly enlarging and modifying future editions according to need.

May the little volume give to its reader an equal amount of joy as the author has experienced in preparing the same.

H. P.

St. Louis, Mo., April, 1907.
602 Century Building.

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CHAPTER I.

PLASTER OF PARIS PREPARATIONS, SEPARATING MEDIA, CAST VARNISHES, INVESTMENT COMPOUNDS FOR METALLIC PLATE BASES AND CAST INLAYS, MOULDING MATERIALS, ETC.

TO COLOR PLASTER OF PARIS IMPRESSIONS.

Dissolve a few crystals of red aniline (cosine) in the water which is used for mixing the plaster of Paris.

TO INCREASE THE COHESION OF PLASTER OF PARIS FOR IMPRESSION PURPOSES.

Add to the freshly mixed plaster of Paris a small quantity of loose fibers of absorbent cotton.

IMPROVED IMPRESSION MATERIAL.

I.

Plaster of Paris	10 parts
Powdered asbestos	12 parts
Powdered chalk	4 parts
Marble dust	1 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Powdered sand	3 parts
Powdered chalk	3 parts
Marble dust	3 parts
Plaster of Paris	6 parts

The compound may be colored with Mineral Red, Crocus Martis, etc. Low fusible alloys may be readily poured into the dried and warmed impression made of these compounds.

TO HARDEN PLASTER OF PARIS CASTS.

1.

Borax	1 part
Water	50 parts

Boil the dried plaster cast in the solution.

2.

Prepare a saturated solution of sodium bicarbonate and place the dried cast in this solution until it is saturated with it. Remove and dry.

3.

Barium sulphate	1 part
Hot water	10 parts

Place the dried cast in the solution for about fifteen minutes. Remove and dry.

4.

Prepare a saturated solution of boric acid in hot water and add sufficient water of ammonia to form the soluble ammonium borate. Mix the plaster with this cold solution

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

or saturate the dry cast with it. In a few days the cast will be sufficiently hard to allow polishing with a soft wheel brush.

5.

Freshly slacked lime, sifted.....	1 part
Plaster of Paris.....	6 parts

Mix with hydrant water.

The thoroughly dried cast made of this mixture is placed in a fairly saturated aqueous solution of zinc sulphate or iron sulphate and kept in the respective solution for two hours. It is then removed and dried. Zinc sulphate does not alter the white color of the cast, while iron sulphate produces a light green shade which, in time, gives an "oxidized" appearance to the cast. Casts prepared according to this method are about twenty times as hard as ordinary plaster casts.

6.

The plaster cast is dried at about 250° F. until it is deprived of all moisture. It is now placed in a heated aqueous solution of barium hydrate (5%) and kept there until saturated. The cast is removed, dried and smoothened with fine sandpaper and placed in a 10 percent aqueous solution of oxalic acid, in which it remains a few hours. The color of the cast is not altered by this treatment. If a permanent tint is required, the plaster cast is placed, prior to the above treatment, into a fairly saturated solution of copper sulphate, or iron sulphate, or chrome sulphate, thus producing, respectively, bluish, greenish, and orange tints. (Wachsmuth's process.)

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

7.

Marbleized Plaster of Paris Casts.

Powdered alum	4 parts
Ammonium chloride	4 parts
Plaster of Paris	17 parts

Mix thoroughly, stir in water, and cast in the ordinary way.

8.

Encaustic Plaster of Paris Casts.

Heat the plaster cast to about 175° F.; place into melted stearic acid and keep in this liquid from three to five minutes; remove and, after drying, burnish with a soft brush until an even polish is obtained. Larger plaster casts may be saturated with a solution of

Stearic acid	3 parts
Gasoline*	20 parts

After the evaporation of the gasoline the cast is treated as outlined above.

9.

Beerite.

Very fine marble dust	100 parts
Very fine powdered glass	15 parts
Very fine freshly slacked lime	7 parts

* In all cases where gasoline or benzine is recommended for preparing solutions of fats, oils, resins, rubber, etc., for technical purposes, carbon tetrachloride is preferably employed. Carbon tetrachloride (CCl_4), commercially known as "Carbonna" and by other proprietary names, is a non-inflammable efficient substitute for the above hydrocarbons.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

The carefully mixed and sifted powder is mixed with a thin aqueous solution of sodium silicate (dental silex, soluble glass) and immediately cast into the mould. The cast requires from three to four hours for complete hardening. Beerite produces very hard and sharp casts.

TO HASTEN THE SETTING, AND TO PREVENT EXPANSION OF PLASTER CASTS.

One part of potassium sulphate, or sodium chloride, or alum, dissolved in eight parts of water before adding the plaster of Paris, hastens its setting very materially and, to some extent, prevents expansion.

TO RETARD THE SETTING OF PLASTER CASTS.

1.

Mix the plaster of Paris with from two to four percent of powdered marshmallow root; the addition of four percent retards the setting of the cast about one hour.

2.

Very small quantities of citric acid (lemon juice) or acetic acid (vinegar), added to the water before mixing the plaster of Paris, will retard its setting.

TO PREVENT WARPAGE OF PLASTER CASTS.

The prompt separation of the cast from the impression will largely obviate warpage.

TO DISSOLVE "SET" PLASTER OF PARIS.

Prepare a cold saturated solution of sodium hyposulphate (also known as sodium thiosulphate or as the "hypo" of the photographer) in water and place the plaster of

---

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Paris cast or article covered with it into this solution. An ordinary dental cast, when placed in this solution, will become completely disintegrated within a few hours.

TO REMOVE PLASTER OF PARIS FROM RUBBER PLATES.

Immerse the plate for a half hour into a weak solution of hydrochloric acid, remove, and wash in a weak solution of sodium carbonate.

A SIMPLE MEANS OF REMOVING PLASTER OF PARIS BANDAGES.

In spite of the use of special instruments, the removal of plaster of Paris bandages, etc., is often troublesome and, in case of a recent fracture, may cause injury. Methods of softening the plaster by water, either alone or with the addition of salt, are rarely successful, as the bandage becomes coated with a layer of grease, which prevents their action. Satisfactory results have been obtained by thoroughly moistening the line of section with vinegar applied on a tampon of cotton wool. After a minute the plaster will be found completely softened so that it may be easily divided with a pocket-knife or ordinary scissors—a procedure easy for the surgeon and painless for the patient. By this method a plaster case for fracture of the femur, consisting of 80 turns of bandage, may be removed in about a minute and a half.

TO REPAIR BROKEN PLASTER OF PARIS CASTS.

(Model Cements.)

I.

Celluloid	1 part
Acetone	2 parts

Keep well corked and away from fire.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Solution of sodium silicate (dental silex, soluble glass) ..... 1 part
Barium sulphate, enough to make a paste.

3.

Zinc oxyphosphate cement, mixed to a thin cream.

P. S.: The plaster casts must be perfectly dry before any cement can be used successfully.

SEPARATING FLUIDS FOR PLASTER OF PARIS CASTS.

1.

Powdered shellac ..... 2 parts
Borax ..... 1 part
Hot water—*not* boiling..... 32 parts
Water-soluble aniline dye, enough to color.

Put the ingredients into a bottle and shake well. The solution will be ready for use in two or three days.

2.

Castor oil..... 3 parts
Alcohol ..... 1 part
Alcohol-soluble aniline dye, enougn to color.

This solution is ready for immediate use.

3.

Scrubbing soap..... 1 part
Hot water..... 8 parts
Dissolve and add
Lard oil..... 8 parts
Shake well before using.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

4.

Boiled linseed oil painted very thin over the impression forms a good separating medium.

IMPRESSION VARNISHES.

1.

Sandarac	2 parts
Alcohol*	5 parts

2.

Shellac	2 parts
Alcohol	6 parts

VARNISHES FOR PLASTER CASTS.

1.

Sandarac	4 parts
Mastic	2 parts
Venice turpentine	1 part
Alcohol	10 parts

The varnish is colorless, elastic and leaves a fine, glossy surface. Any alcohol-soluble aniline dye may be added to give the desired tint.

2.

Sandarac Varnish.

Sandarac	1 part
Rosin, light colored	1 part
Alcohol	2 parts

* Tax-free denatured alcohol, i. e., grain alcohol made unfit for internal purposes by the addition of small quantities of wood alcohol, etc., may be successfully substituted for the high-priced pure grain alcohol in all technical preparations.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Shellac Varnish.

3.

Shellac	1 part
Alcohol	3 parts

P. S.: Alcoholic varnishes may be made elastic by the addition of 2 or 3 parts of castor oil to every 100 parts of the finished varnish.

4.

Collodion Varnish.

To four parts of sulphuric ether add two parts of collodion and two parts of "Silver Gloss" (to be obtained from dealers in painters' supplies). Let the mixture stand for 48 hours, and shake well before using. Keep well corked.

5.

Dental Silex.

Solution of sodium silicate, also known as liquid or soluble glass, is diluted with 2 to 3 parts of warm water. Let stand for ten days and pour off the supernatant solution.

MOLDS FOR DUPLICATING PLASTER CASTS FROM ORIGINAL CASTS OR MODELS.

1.

Fresh slacked lime	10 parts
Sugar	10 parts
Glycerin	12 parts

Dissolve the sugar in the glycerin by heating upon a water bath, and stir in the lime.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Carpenter's glue	25 parts
Gelatin	25 parts
Glycerin	35 parts
Water	25 parts
Olive oil	20 parts

Place the glue, the gelatin and the water in an enameled rice boiler, let stand for twenty-four hours, heat until dissolved and add the glycerin and olive oil under constant stirring.

Directions: Place the dry, talc-coated model in the moulding flask and pour the warm solution over it. Let it stand until perfectly hard. Carefully remove the cast from the elastic mould. A number of casts may be obtained from the same mould.

PREPARATION AND PAINTING OF DURABLE PLASTER CASTS.

Professor Port, of the Heidelberg Dental School, has adopted the following method: Three parts of plaster of Paris and one part of whiting are very intimately mixed by running this mixture through a fine sieve. For a binding fluid a solution of French hare or any other good quality of carpenter's glue, in water, is used. This is prepared by soaking five parts of the glue in one hundred parts of water for about 12 hours and heating the mixture until solution takes place. A very thick mixture of the powder and the liquid glue is now prepared and, as this cannot be poured, it is carefully painted into the impression with a fine hair pencil. A few more layers are added with the pencil, rocking the tray after each addition to prevent air bubbles, and finally the tray is filled up with a spatula. At least twelve hours are necessary before the cast is separated.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

The impression should be well soaped; no oil or varnish must be used. Modeling compound impressions must be perfectly dry.

After separation, the cast should be further dried for about a week, when it is ready to be painted. A thin coat of boiled linseed oil is brushed over the surface and after this is thoroughly dry, the cast is then painted with artist's tube oil colors, thinned down with oil of turpentine. The following list of colors is given by the author:

1. Madder lake 3, dark rose.
2. Bright English red.
3. Carmine cinnabar.
4. Light ochre No. 1.
5. Brilliant yellow, light.
6. Terra di Siena.
7. Prussian blue.
8. Parisian ultramarine.
9. Green, light cinnabar.
10. Burned Terra di Siena.
11. Ivory black.
12. Kremnitz white.

Kremnitz white (a fine quality of white lead), mixed with carmine cinnabar is to be used to represent normal mucous membrane, while inflamed membrane will be nicely represented by madder lake mixed with light ochre; white, slightly blended with light ochre, produces a color similar to that of the teeth. The balance of the model is to be painted black.

Water colors may be used for the same purpose; the painted casts must then be varnished.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Aluminum enamel paint makes a good, durable cast varnish and paint combined.

TO BRONZE PLASTER CASTS.

Prepare the cast by sizing it once or twice with boiled linseed oil. The dry cast is now bronzed with any desirable shade of either dry or wet bronze.

CLEANING OF PLASTER CASTS.

1.

Make a thick paste of powdered cornstarch and hot water, and, with a soft brush, paint the hot mixture evenly over the cast. The layer of starch must be quite thick. After drying slowly, the starch will split and may be scalded off with the dirt without injury to the cast.

2.

Prepare a saturated solution of boric acid in ammonia water, place the dried cast in this solution until thoroughly saturated; remove and dry.

MOLDINE.

Pure dry clay is mixed with sufficient glycerin to make a plastic mass.

TO RESTORE HARDENED MOLDINE.

Place the moldine in a vessel and cover with a mixture of

Glycerin	1 part
Water	9 parts

Boil, under constant stirring, until the water is evaporated.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PLASTILINE.

(Artificial Modeling Clay.)

Lard	50 parts
Washed sulphur	30 parts
Clay	14 parts
Zinc oxide	6 parts

MOLDING SAND.

Molder's sand, a fine quality	3 parts
Powdered clay	1 part

Mix with

Glycerin	1 part
Water	2 parts

OILED MOLDING SAND.

Best dry molding sand	5 parts
Sperm oil	1 part

Thoroughly mix and sift.

INVESTMENT COMPOUNDS FOR SOLDERING, CHEOPLASTIC CASTINGS, ETC.

1.

Plaster of Paris	4 parts
Molding sand	4 parts
Fire clay	1 part

Powder, mix and pass through a fine brass wire sieve.

2.

Anthracite coal ash	20 parts
Plaster of Paris	30 parts
Powdered soapstone	3 parts
Mineral red	2 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

Plaster of Paris	7 parts
Asbestos powder	5 parts
Powdered soapstone	1 part

4.

Plumbago	1 part
Calcined marble dust	1 part
Plaster of Paris	2 parts

5.

Powdered soapstone	1 part
Plumbago	3 parts
Asbestos, grade No. 3	5 parts
Plaster of Paris	7 parts

P. S.: Pumice stone should not be used in an investment compound. Pumice stone is a form of vulcanic glass which readily melts when heated, thereby edging the enamel of the artificial teeth.

Borax and silicates in the form of sand, etc., which are present in many investment compounds, readily unite, even at a low heat, to form a low fusing glass which may run over the teeth during soldering. The teeth become rough and covered with numerous small cracks.

INVESTMENT COMPOUNDS FOR GOLD CAST INLAYS, ETC.

1.

English China clay	2 parts
Powdered pure sand	2 parts
Plaster of Paris	3 parts

2.

Powdered soapstone	1 part
Powdered asbestos	9 parts
Plaster of Paris	10 parts
Powdered pure sand	10 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

Plaster of Paris	12 parts
Powdered silex	5 parts
Powdered Ceylon graphite	3 parts

4.

Powdered mica*	1 part
Marble dust	1 part
Plaster of Paris	2 parts

5.

Plaster of Paris	2 parts
Powdered silex† (lithowhite)	3 parts

6.

Powdered soapstone	2 parts
Marble dust	2 parts
Graphite	2 parts
Plaster of Paris	6 parts

7.

Good quality of ordinary dental plaster	2 parts
Powdered mica	1 part
Marble dust, pulverized fine	1 part

Quantities are by measure, *not* by weight.

The mica and marble dust should both be powdered as fine as flour.

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* Powdered mica may be obtained from the United States Mica Mining & Milling Company, at Micanite, Colorado.

† Powdered pure sand, silex, lithowhite, "Kiesel," "Kieselguhr," are names given to, more or less, the same substances, i. e., impure preparations of silicon oxide. Silex, or lithowhite, may be obtained from the Bridgeport Wood Finishing Company, 72 W. Lake Street, Chicago, Ill.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

BAKED CLAY MODELS.

The plaster of Paris impression is filled with a hot gelatin or glue solution (see page 20). After cooling, a perfect thick walled impression of this cast in hard plaster of Paris is prepared, and set aside for a few hours to dry. A good quality of potter's clay is now carefully pressed in this impression and set aside in a warm place for two hours to dry. The impression is now carefully removed and the clay model is lightly burned at about 1800° F. in a suitable furnace. The cold model is now coated with a mixture of Majolika enamel and water and burned again. Three colors of enamel are required; pink for representing the mucous surfaces, ivory for the teeth and black for the body of the model.

FIRE BRICKS.

When not exposed to mechanical injury a mixture of one part (bulk) of fireclay and three to four parts (bulk) of sawdust, moistened with water and worked into form and burnt, enables a very much higher temperature to be obtained in a furnace then can be obtained with ordinary firebricks. In building a furnace of firebricks or slabs, fireclay must be used as cement instead of mortar. The fireclay should not be mixed with water as is usually the case, but with a solution of silicate of soda. A furnace of this kind is readily adapted to muffles for continuous gum work, crucibles, ladles, etc. If the furnace is required for muffles, a ledge should be left at the back about five inches above the top of the fire box to carry the muffle and the front will have to be built up, leaving a hole for the door about nine inches above the top of the muffle, to enable fresh fuel to be added as required. If the shaft is nine inches wide clear

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inside, the muffle should not exceed four and a half inches, as room is required on each side to allow the fuel to fall down over the sides of the muffle. If no blower is used a high chimney is required to furnish the necessary draught.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER II.

GUTTA-PERCHA PREPARATIONS, DENTAL RUBBERS, MODELING AND INLAY WAXES, PLASTIC IMPRESSION COMPOUNDS, ETC.

SOLUTION OF GUTTA-PERCHA.

Purified gutta-percha	10 parts
Chloroform	95 parts
Absolute alcohol	5 parts

TRAUMATICINE.

Purified gutta-percha	1 part
Chloroform	9 parts
Lead carbonate	1 part

Shake the mixture frequently until complete solution of the gutta-percha has taken place. Set aside for a few days and finally decant the clear liquid. Keep in well stoppered bottles.

CHLORO-PERCHA.

Gutta-percha base plate	10 parts
Chloroform, a sufficient quantity.	

EUCA-PERCHA COMPOUND (BUCKLEY).

Gutta-percha base plate	480 parts
Menthol	16 parts
Thymol	24 parts
Eucalyptol	480 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

TEMPORARY STOPPING.

1.

White beeswax	1 part
Gutta-percha base plate	4 parts
Prepared chalk	4 parts

Melt the wax on a water bath, add the gutta-percha, stir until liquefied, and incorporate the chalk. Knead until thoroughly mixed and pass through a dental rolling mill, having grooved rolls.

2.

Gutta-percha base plate	2 parts
Zinc oxide	8 parts
Calcium sulphate	1 part

3.

Flagg's.

White beeswax	2 parts
Gutta-percha base plate	6 parts
Powdered silex	3 parts
Powdered feldspar	3 parts

4.

Hill's.

Powdered feldspar	1 part
Powdered silex	1 part
Powdered quicklime	2 parts

Gutta-percha base plate, a sufficient quantity to make a stiff mass.

5.

Jacob's.

Gutta-percha base plate	1 part
Powdered silex	4 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

6.

Coppered Gutta-Percha.

Gutta-percha base plate	6 parts
Copper oxide, black	6 parts
Zinc oxide	12 parts

7.

Silver Nitrate Gutta-Percha.

Gutta-percha base plate	2 parts
Zinc oxide	10 parts
Silver nitrate	1 part

8.

Aluminum Gutta-Percha.

White gutta-percha base plate	16 parts
Aluminum powder	10 parts
Zinc oxide	2 parts
Prepared chalk	1 part

9.

Stanno-Percha.

Equal parts by weight of gutta-percha base plate and sifted sponge tin (see page 71) are put in a mortar, the mortar is placed in a heated sand bath and the ingredients are thoroughly kneaded until a grayish-blue mass is obtained. The mass is now divided into two equal parts; the first portion is reserved, while the second portion is again kneaded with an equal amount of sponge tin. The first portion is soft and is used for lining the cavity, while the second (harder) portion is used for the body of the filling.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

IMPRESSION GUTTA-PERCHA.

Gutta-percha	35 parts
Zinc oxide	9 parts
Vermillion	56 parts

IDEAL BASE PLATE.

1.

Black gutta-percha	1 part
Shellac	18 parts

2.

Shellac	1 part
Perfection impression material (Detroit)	1 part

Melt the shellac on a low fire and gradually add, under constant stirring, the impression compound. Pour on a glass slab and roll with a wet rolling pin to the desired thickness.

3.

Artificial shellac (metakaline)	1 part
White beeswax	4 parts

DENTAL RUBBERS.

(After Dr. E. Wildman.)

Dark Brown.

Caoutchouc	48 parts
Sulphur	24 parts

Red.

Caoutchouc	48 parts
Sulphur	24 parts
Vermillion	36 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Dark Pink.

Caoutchouc	48 parts
Sulphur	24 parts
Zinc oxide	30 parts
Vermillion	10 parts

Grayish White.

Caoutchouc	48 parts
Sulphur	24 parts
Zinc oxide	96 parts

Black.

Caoutchouc	48 parts
Sulphur	24 parts
Ivory, or drop black	24 parts

Jet Black.

Caoutchouc	48 parts
Sulphur	24 parts
Ivory, or drop black	48 parts

TO RESTORE HARDENED DENTAL RUBBER.

Place the rubber sheet in warm water, let it soften, remove the cloth sheets and now thoroughly brush the rubber with warm soap suds. Wash in warm water, dry the sheets and with a soft sponge dipped in oil of turpentine thoroughly wash over the sheets on both sides. After the oil of turpentine has been absorbed, the rubber is ready for use.

TO MAKE A TRUE RUBBER SOLUTION.

Ethylene dichloride, *not* ethyl chloride, gives a true solution, not merely a diffusion of rubber, and has the advantage of being non-inflammable. Its solvent power is

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

greater than carbon disulphide, chloroform and carbon tetrachloride; it has a boiling point of 130° F. and is more volatile than other solvents, and its vapors are non-explosive.

COLD VULCANIZATION.

Sulphur chloride	1 part
Carbon disulphide	30 parts

The rubber cast is plunged in this solution and left there from 60 to 70 seconds. It is now removed, left to dry in a warm room (about one to two minutes) and washed in a weak alkaline solution, i.e., a 2 percent solution of sal soda in water.

CONSERVATION OF VULCANIZED RUBBER GOODS.

It is claimed by Hempe that the gradual hardening and deterioration of vulcanized India rubber goods is due to the spontaneous evaporation of the solvent liquids contained in India rubber and those introduced during the process of vulcanization. Other observers claim that the evaporation of the solvents, especially in the presence of air and sunlight, or in cold temperature, causes the sulphur present in the vulcanite gradually to oxidize and finally to form sulphuric acid which, in turn, destroys the rubber. Keeping the rubber goods immersed in a weak alkaline aqueous solution or in paraffin oil, stored away from light at room temperature, will act as a permanent preservative.

According to Larine, there are only three solutions of the many employed in experimental work which have shown themselves to be of practical value, namely, a 3 percent solution of phenol, a 3 percent solution of aniline, and an 8 percent solution of glycerin, with an equal amount of alcohol, in water

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Three percent phenol is the best method of all. The author has seen tubes that had been immersed for ten years in this liquid which had not altered a particle during this long period; a truly remarkable fact, when we consider the rapidity with which such articles deteriorate in the air. The only precaution to be observed is to have the containers of such size as to prevent kinks. Another advantage is that the liquid does not change its character. The flasks may be opened at any time without the necessity of preparing a fresh solution.

Three percent aniline acts in a similar manner, though a slight lengthening and increase in volume is noted in the case of black rubber.

Alcohol-glycerin solution has no effect on deteriorated articles, but new rubber goods are preserved when immersed therein.

PRESERVING RUBBER DAM.

Secure only such rubber as is in the best possible condition. Too much care in this direction can not be exercised. Rubber, being an organic substance, necessarily undergoes a changs when exposed to the air and must, therefore, be protected in order to insure its usefulness. To accomplish this end, secure a number of Mason's glass jars, filling the same with pure boiled water and adding to each jar of water a few drops of such antiseptics as phenol or lysol. Then immerse a loose roll of fresh rubber dam in an upright position, taking the precaution to shake out all the air between the folds before screwing on the cover. The jar should at all times be filled with water to the point of overflowing in order to exclude all air. Rubber preserved in the above manner can be kept in perfect condition, if necessary, for a period of about one year. For use, remove

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

the desired amount, dry the rubber and rub down with talcum powder.

STICKY WAX.

1.

Rosin	16 parts
Yellow beeswax	8 parts
Vermillion	1 part

Melt on a water bath and stir together, pour on a glass slab and roll with wet fingers into pencils or pour in molds (see page 39).

2.

Yellow beeswax	4 parts
Rosin	1 part
Gum dammar	1 part

3.

Yellow beeswax	1 part
Rosin	3 parts

4.

Gum dammar	1 part
White beeswax	4 parts
Light yellow rosin	7 parts

5.

Yellow beeswax	48 parts
Light rosin	84 parts
Gum dammar	12 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PINK BASE PLATE WAX.

1.

White beeswax	50 parts
Paraffin	25 parts
Alkanet root, whole	1 part

Melt the wax and the paraffin and add the alkanet root. Leave on the fire until the desired shade of pink is obtained, strain through cheese cloth into tin molds, about 1-32 or 1-16 inch thick. Have the molds coated with a film of glycerin. The lids of the tin boxes in which dental rubber is sold make good molds.

To polish the sheet wax, pass between the rubber rollers of a wash wringer.

2.

White beeswax	40 parts
Gum turpentine	10 parts
Cotton seed oil	3 parts
Vermillion	4 parts

3.

(To be used in hot weather.)

White beeswax	20 parts
Crude turpentine	4 parts
Cotton seed oil	1 part
Vermillion	2 parts

4.

(To be used in cold weather.)

White beeswax	20 parts
Crude turpentine	6 parts
Cotton seed oil	2 parts
Vermillion	2 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

5.

Hard Base Plate Wax.

Yellow beeswax	50 parts
Gum mastic	6 parts
Prepared chalk	3 parts
Vermillion	4 parts

6.

Rosin	1 part
Ceresin	3 parts
Paraffin	6 parts

MAKING SHEET WAX.

1.

Melt the wax in a rather narrow vessel; fill a round, smooth pint bottle with cold water, coat the outer surface with a film of glycerin or soap suds and dip the bottle in the melted wax, quickly remove it and, if the wax coat is not sufficiently thick, dip again. Cut the sheet with a sharp pen knife and immediately flatten out.

2.

Take two pieces of ordinary glass; have both warm, dry and oiled. Place the first piece upon a flat surface and at each corner place a small block of wood of the thickness of the wax desired. Pour a sufficient quantity of the melted wax upon the plate and quickly lay the second glass over the first, pressing the same until each corner touches the gauge blocks.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

A porous cell, made for electric batteries, about 3¼ by 7 inches, is filled with cold water, and thoroughly wet all over. Wipe the cell with a damp sponge or cloth to remove superfluous moisture; then with a steady hand plunge the cell down into the wax, and remove rather slowly. The wax should not be too hot—the cooler it becomes the thicker the sheets will be. If very thick sheets are desired a second plunge may be made. Quickly cut the sheets on opposite sides of the cylinder, remove, and place in a pan of cold water. After three or four plunges put fresh cold water in the cell. The sheets may be trimmed by shearing before they become too cold and brittle.

GOLD INLAY IMPRESSION WAXES.

1.

Yellow beeswax	10 parts
Gum dammar	10 parts
Yellow ceresin	20 parts
Hard paraffin (120° F. melting point)	30 parts
Carnauba wax	30 parts
Dye stuff, to suit.	

Melt the beeswax, ceresin, paraffin and carnauba wax in a porcelain dish on a water bath, add the gum dammar in small portions and stir constantly until a uniform mass is obtained. Remove from the fire and add the dye stuff.

Gold inlay waxes should be colored deeply with a dye especially suitable to the needs of the operator. Lamp black or an oil-soluble aniline dye are best suited for this purpose. (The red and blue "Cerasine" aniline dyes are to

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be recommended). Gold inlay wax may be cast into sticks as outlined below.

2.

Inlay Impression Wax, W. A. Price.

White gum dammar	110 parts
Tamarack*	10 parts
Paraffin	15 parts
Stearic acid	2 parts

3.

White beeswax	1 part
Hard paraffin	1 part

4.

Yellow beeswax	10 parts
Carnauba wax	30 parts
Hard paraffin	50 parts

CASTING STICKS OF STICKY-WAX, INLAY IMPRESSION WAX, ETC.

Obtain glass tubing of convenient length; the tubing should have fairly thick walls. The bore may be of any diameter, three-sixteenths to one-fourth inch gives convenient sticks of wax. The ends of the tubes should be ground, not melted smooth, as melting lessens the bore at the point of fusion. Thoroughly clean the tubes and dry the inside by pushing pieces of cotton wool through them. The tubes must then be lubricated to prevent the wax from sticking. Do not lubricate with oils; glycerin forms a very effective lubricant for this purpose; and is easily applied

* Tamarack is a trade name for American larch turpentine.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

by saturating pieces of cotton wool with it and pushing them through the tubes.

Having the wax melted and the tubes lubricated, fill each of the tubes as follows: Attach a piece of rubber tubing to one end of the glass tube; take the other end of the rubber tubing in the mouth. Dip the free end of the glass tube into the melted wax and suck the wax up until the tube is full. Pinch the rubber tubing close to the glass tube, and the tube, full of wax, can then be lifted and laid in a horizontal position. Then release and remove the rubber tubing. The wax will not run out. Repeat the process until all the tubes are filled. When cool, the sticks of wax can readily be pushed out of the tubes. If a piece of wax should stick in a tube, it is either because the tube was not properly lubricated or because its bore was not uniform. Pink wax base plate may be cast into sticks for "waxing up" in the same manner, but owing to the much greater fluidity of pink wax when melted, it is more difficult to manipulate.

ENGRAVER'S WAX.

1.

Yellow beeswax	1 part
Tallow	1 part
Burgundy pitch	2 parts

2.

Cottonseed oil	1 part
Rosin	1 part
Beeswax	2 parts

IMPRESSION WAX.

Yellow beeswax	7 parts
Hard paraffin	1 part

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MODELING WAX.

1.

Lard	15 parts
Venice turpentine	25 parts
Yellow beeswax	200 parts
White bole	150 parts

Melt the wax, turpentine and lard together, then incorporate the white bole. When a uniform mass is obtained, pour the mixture into cold water. Knead the mass under the water until it assumes a uniform degree of plasticity.

2.

Olive oil	1 part
Venice turpentine	4 parts
Cornstarch	8 parts
Yellow beeswax	16 parts
Vermilion	1 part

FLOOR, OR FURNITURE WAX.

Venice turpentine	1 part
Rosin	4 parts
Yellow beeswax	16 parts

TO CLARIFY WAX REMNANTS.

1.

Melt the wax remnants, bring to a boil, and break a fresh egg in the boiling wax; stir for 3 to 4 minutes, until the egg is coagulated, and strain through cheesecloth.

2.

In a flat vessel, having sloping sides, melt a pound of

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wax remnants in an equal amount of water; stir a tablespoonful of sulphuric acid, added in a slow stream, into the hot wax; let it cool, and cut off the lower sediment.

3.

The wax remnants are melted and strained through cheesecloth and boiled in

Oxalic acid	1 part
Water	50 parts

After cooling, the wax is separated from the oxalic acid solution.

TO FILTER WAX.

The wax may be dissolved in chloroform, carbon disulphate or other solvents, and then filtered through paper in a well-covered heated glass funnel. A simpler method consists in heating the wax with 5 percent of its own weight with sodium sulphate on a water-bath for about 15 minutes and then filtering through a cotton plug inserted into a glass funnel surrounded by a hot water jacket.

TO DETERMINE THE MELTING POINT OF WAXES, FATS, RESINS, ETC.

The material whose melting point is to be determined is carefully melted in a small, perfectly dry beaker, and a capiliary tube is dipped into the liquefied substance, and, when filled, one end of the tube is sealed in the flame and it is then put aside in a cool place for several hours. At the end of this time the tube is tied to the bulb of a delicate thermometer, the length of the tube being the same as the thermometer bulb. The thermometer and attached tube

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are placed in water and gently warmed until the capillary column of the wax, fat, etc., becomes transparent. At this moment the thermometric reading is made, which indicates the melting point of the substance under observation.

MODELING COMPOSITION.

1.

Stearin	25 parts
Gum dammar	50 parts
Powdered soapstone	85 parts
Carmine, enough to color.	

Melt the stearin on a water-bath, add the gum dammar, and when melted stir in the powdered soapstone, tinted with the carmine.

2.

Stearic acid	20 parts
Oleic acid	4 parts
Gum copal	19 parts
Kraplac	17 parts
Powdered soapstone	40 parts

3.

Manila copal, golden yellow	30 parts
Light-colored rosin	30 parts
Carnauba wax	10 parts
Stearic acid	5 parts
Powdered soapstone	75 parts
Carmine, enough to color.	

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4.

Best light-colored rosin	50 parts
Gum copal	2 parts
Yellow ceresin	8 parts
Gum turpentine	5 parts
Powdered soapstone	50 parts
Menthol	½ part
Fresh slacked lime	10 parts

Coloring.—Red: Florentine lake. Brown: Crocus martis (iron hydroxide).

5.

Stearin	25 parts
Semi-solid gum copal	25 parts
Powdered soapstone	50 parts
Carmine, enough to color.	

CARVING COMPOUND FOR CROWN CUSPS.

(Metalloid Compound.)

Powdered Ceylon graphite	1 part
Perfection impression material (Detroit)	4 parts

Melt the perfection impression material in a porcelain capsule on a water-bath, add the graphite under constant stirring, and roll or mould into sticks.

ELASTIC COMPOUND FOR CROWN AND PLATE SWAGER.

Gelatin	250 parts
Zinc oxide	175 parts
Glycerin	400 parts
Water	300 parts

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Mix the zinc oxide with 200 parts of glycerin to a smooth paste; boil the gelatin in the water and the remaining glycerin until dissolved, and stir it into the zinc oxide paste. After 12 hours the mass becomes solid, resembling unvulcanized rubber.

LIQUID CONTINUOUS GUM ENAMEL.

Pink celluloid	15 parts
Oil of cedar wood	5 parts
Acetone	30 parts

Paint the solution two or three times over that portion of the vulcanite plate which is usually occupied by pink rubber. Each coat must be thoroughly dry before the next is added. Polish with prepared chalk.

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CHAPTER III.

CEMENTS, ADHESIVES, AND VARNISHES.

DENTAL CEMENTS.

Dental cements may, according to their chemical nature, be divided into:

Oxy-phosphate of zinc cements,
Oxy-chloride of zinc cements,
Oxy-sulphate of zinc cements, and
Silicate cements.

The Oxy-Phosphate of Zinc Cements.

The oxy-phosphate of zinc cements were introduced into dentistry in 1878 by the Rostaing Brothers, of Dresden, by the name "Dentinogen." On account of their superiority regarding their wearing qualities over the other dental cements, they at once gained great popularity, and in reality they have become an indispensable medium for certain phases of reconstruction of tooth substances, the attachment of artificial substitutes to natural teeth, etc.

The liquid of the oxy-phosphate cements consists of a more or less concentrated phosphoric acid solution, to which some manufacturers have added zinc phosphate, aluminum phosphate, or strontium phosphate, in various proportions, more or less, to the point of saturation.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Commercially, three forms of phosphoric acids are met with:

1. Orthophosphoric acid, U. S. P., H_3PO_4. It is a colorless, inodorous, strongly acid liquid of a syrupy consistency which is miscible with water and alcohol in all proportions. It has a specific gravity of 1.710 and contains about 85 percent of absolute orthophosphoric acid. Besides this acid, weaker solutions (a 50 percent and a 10 percent solution) are also found in the market. On standing, the acid gradually deposits crystalline prisms, which are readily redissolved when slightly heated. Orthophosphoric acid readily absorbs water from the atmosphere.

2. Metaphosphoric acid or glacial phosphoric acid: HPO_3. It is found in commerce in glassy sticks or lumps, containing from 10 to 15 percent sodium metaphosphate, which is added to give tenacity, transparency and hardness to the sticks. The acid is readily soluble in water, the solution gradually changes to orthophosphoric acid. The acid is very hygroscopic.

3. Pyrophosphoric acid: $H_4P_2O_7$. It is a white, hygroscopic, glassy mass which gradually changes to orthophosphoric acid.

A satisfactory acid for dental cement powders may be prepared in the following manner: One part of pure zinc phosphate, twenty parts of glacial phosphoric acid in sticks, and ten parts of distilled water, all quantities by weight, are placed in a glass stoppered bottle and set aside in a moderately warm place and occasionally shaken until the solution is completed. The acid is then filtered through a cone of glass wool placed tightly into the neck of a glass funnel. The first portions of the filtrate are returned to the funnel until the solution runs off perfectly clear. The acid is

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immediately transferred to small glass bottles and tightly corked. Care should be taken to have the bottles perfectly dry. If the cement powder when mixed with the acid hardens too quickly, the latter should be slightly concentrated on a sand bath; if the cement sets too slowly, a very small quantity of distilled water should be added to the acid. Occasionally it will be found that the last part of the acid gives poor results when mixed with the powder; it is then best to discard the fluid instead of trying to remedy the evil by heating, etc. A small office preparation bottle with a ground glass cap makes a good container for the acid for office use.

The powder of the oxy-phosphate cements consists principally of a pure zinc oxide prepared especially for this purpose, and it is usually referred to as a basic zinc oxide. This basic zinc oxide may be employed in its pure form or more or less tinted with various metallic oxides to produce the desired shades. Some makers add small amounts of specially prepared Portland cement to the zinc oxide. It is claimed that the well-known Harvard cement represents a mixture of this kind. Various analyses made have shown that the powder of the Harvard cement contains approximately 87 percent of basic zinc oxide and 13 percent of Portland cement. A Portland cement for such purposes may be prepared by carefully mixing

Calcined tripoli	60 parts
Pure dry aluminum oxide	30 parts
Pure dry calcium oxide	10 parts

A pure zinc oxide may be prepared by dissolving pure metallic zinc in nitric acid, U. S. P. The solution is evaporated in a porcelain vessel until it solidifies on cooling. The

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basic zinc oxide may be prepared as follows: A pound of pure zinc oxide, prepared as above, or one of the English preparations known as Hubbuck's or Wilson's, is thoroughly mixed with a quarter of an ounce of boric acid previously dissolved in water or alcohol. The mixture is tightly packed into a Hessian crucible covered with a fire-clay slab and put into a warm place to dry, and then exposed to a white heat for several hours. After cooling, the crucible is broken, the vitrified zinc oxide is powdered, passed through fine bolting-cloth, and bottled for use. The cement powder thus prepared should not be exposed to the atmosphere, as it readily absorbs moisture. Cement powder may also be prepared by using a mixture of

Pure zinc oxide	250 parts
Pure magnesium oxide	50 parts
Boric acid	5 parts

or by mixing pure zinc oxide with a 2 percent nitric acid solution well diluted with water. The process of vitrification is the same as referred to above. Much of the basic zinc oxide used for dental cements in the United States is imported from Germany; deHaen's Chemical Works, in List, near Hanover, enjoy a wide reputation for making a very pure article, especially adapted for such purposes.

The tinting of the basic zinc oxide is best accomplished by adding suitable mineral colors. Black oxide of manganese, cadmium sulphide and cobalt blue are useful to produce the various shades desired. Only very small quantities are needed. Yellow ochre and Terra di Siena are also used for such purposes, but with less success. By keeping on hand small quantities of the colors referred to above, the various shades may be extemporaneously prepared.

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(See Appended Formulas for details in preparing the color materials.)

For mixing the cement, a large, thick, polished glass slab and a stiff, non-corroding spatula are best adapted. The spatula should be of German silver; steel spatulas discolor the cement, due to the action of the phosphoric acid. The best results, however, are obtained by using an agate spatula. "The manipulator who becomes familiar with the proper conditions during the mixing of cement as felt under the spatula will obtain far better results than one relying on the incorporating of definite proportions. In mixing any oxy-phosphate, the beginning must be a clean slab and spatula. Then the powder and liquid must be placed thereon sufficiently apart to render it possible to cut in a small addition of powder in a cleanly manner, and incorporate it thoroughly with the liquid, without having a borderland half-mixed, to help impart a clotty condition. Each addition of powder must be manipulated until there is the feeling and appearance of a thorough mixture before more powder is added in the same manner. Take plenty of time, making the additions of powder compare to the volume of the mix, i. e., as many separate additions in making a small mix as a larger one." (Ames.)

The temperature of the glass slab should be approximately 60° F.; a little warmer in a cold room, and vice versa in a warm room. The humidity of the air also materially influences the setting of the cement.

In connection with the application of oxy-phosphate cements the question is frequently asked: Why do pulpa die under an oxy-phosphate cement filling? Analyses made of various cement powders revealed the presence of certain arsenical compounds in very small quantities which were

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apparently demonstrated by the arsenical mirror. This test is seemingly erroneous, as Hauser has shown. Cement powders are frequently tinted with ultramarine, a fine blue pigment which is artificially prepared from a mixture of Glauber's salt, charcoal, soda and sulphur. The presence of small quantities of this pigment in the cement powder gives a sulphur mirror which closely resembles that of the arsenical mirror. It should be remembered that arsenical compounds, if present in the oxide, are probably completely volatilized during the vitrifying process of the latter, or they are changed to some inert compound. The dying of the pulps under an oxy-phosphate cement filling is probably better explained by attributing it to the chronic irritation resulting from the free phosphoric acid present in an incompletely mixed cement, or to a poorly excavated cavity. Careful excavation and varnishing of the cavity prior to inserting the filling materially reduces the danger.

Hydraulic cements, i. e., such as are used for inlay work, give better results, according to Ames, if the cavity prepared for their reception is slightly moistened with water after it has been previously dehydrated with alcohol.

The Oxy-chloride of Zinc Cements.

The powder of these cements consists principally of pure white zinc oxide; it is rarely colored. The English zinc oxide (Hubbuck's or Wilson's) is, in general, to be preferred for cement powders. The oxide should be thoroughly dried before it is employed, and kept in well-stoppered bottles to prevent absorption of moisture from the air.

The liquid of the zinc oxy-chloride cements is usually composed of a concentrated solution of zinc chloride in water. A suitable liquid may be prepared by dissolving

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one ounce of zinc chloride in half an ounce of distilled water; after standing a few days, it is filtered and the solution is then ready for use. To reduce the quick setting of the cement, a small quantity of borax may be added to the powder. The so-called "Sorel" cement is a good example of this class of filling materials. (See Appended Formulas for details in preparing the cement.)

The Oxy-Sulphate of Zinc Cement.

The oxy-sulphate of zinc cement is probably best known in dentistry as "Fletcher's Artificial Dentine." The cement consists of a powder which is usually composed of a pure dry zinc oxide to which small amounts of dehydrated zinc sulphate and, sometimes, powdered gum mastic are added. The fluid is composed of a 40 percent solution of gum arabic in water. (See Appended Formulas for details in preparing the cement.)

The Silicate Cements.

Within recent years much interest has been manifested here and abroad in a new form of dental cements known as silicate cements. These cements are primarily intended to replace gold and, to some extent, porcelain as employed for filling purpose in the anterior teeth. On account of the translucency of the finished plug, these fillings resemble tooth structure closely, and this is probably the reason why they are so extensively used in England and on the European continent. Cultured Europeans object seriously to visible gold fillings. The silicate cements have been in use for about six years, and of late they have been materially improved. Silicate cements are by no means of recent origin. For technical purposes, they are prepared by mixing liquid sodium or potassium silicate (dental silex) with pre-

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

pared chalk, calcium oxide, zinc oxide and other suitable chemicals. As a dental filling material such mixtures are not suitable, although they have been experimented with extensively; they require too much time for hardening. Manufacturing chemists have endeavored to incorporate into the powder of these new cements certain silicates, in conjunction with other suitable compounds, which when properly mixed with the ordinary cement liquid (acid phosphate of zinc solution or liquid orthophosphoric acid) form a comparatively quick-setting cement. The resulting filling possesses the hardness of the ordinary phosphate of zinc cement, with an increased resistency to the fluids of the mouth and a peculiar porcelain-like translucency. A number of analyses have been published relative to the composition of the silicate cement powders, which, with a reasonable percentage of errors, show the following approximate composition:

Quartz	28 to 35 percent
Kaolin	50 to 55 percent
Lime	10 to 12 percent
Magnesia	1 to 2 percent

Some manufacturers, in the circulars accompanying their cements, lay special stress upon the fact that the extraordinary qualities of their products depend upon certain rare metals, especially beryllium. Beryllium, also known as glucinum, is a rare metal belonging to the magnesium group. Its natural oxides are found in certain parts of France and of Norway, and they also occur in crystalline form as emerald, a gem of pure green color, and in opals. The kaolin mined in St. Yrieux, France, of which the celebrated Limoges porcelain is made, contains beryllium oxide; and this very kaolin, on account of its purity, enters

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largely into the make-up of some of the silicate cement powders.

According to a German patent, Ascher's artificial enamel is prepared as follows: A solution of basic beryllium nitrate, $Be(NO_3)_2.2BeO$, is precipitated with sodium silicate, Na_2SiO_3. The precipitate is kept under water for some time. It is then filtered, washed, dried, and lightly calcined. The resultant preparation is ground very fine and mixed with powdered glass or pure china clay.

Schoenbeck's process consists in taking sodium-aluminum fluoride (cryolite), silicic acid and calcium oxide, fusing the same with a beryl admixture up to 5 percent, cooling and pulverizing, and then adding to the resultant powder a phosphoric acid (meta-, ortho- or pyro-) containing a little aluminum hydroxide in suspension, until a plastic mass ensues.

The making of cements of the silicate group as well as of the oxy-phosphate group requires a great deal of technical knowledge which is imperative for its ultimate success. An intimate knowledge of the manufacture of these cements is of less importance to the user than certain definite details regarding its manipulation. For this reason the detailed instructions accompanying the various cements should be closely observed to insure success. Test fillings made in extracted teeth are the best means to acquire the necessary technique. For mixing the cement, nothing but a spatula made of some non-metallic, impervious material will do; an agate spatula gives by far the best service. A few burnishers and round-headed instruments made of agate, bloodstone, or of platinum, gold, nickel and tantulum, or plated therewith, are essential. Metal instruments should be coated with a thin film of vaseline. Silicate cement

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possesses much less adhesiveness than the oxy-phosphate cements, consequently the suitable preparation of the cavity should be duly considered. It should not be packed into the cavity in small pellets, but rather the entire bulk of the filling should be placed at once, pressed into position, and shaped accordingly. Ample time must be allowed for thorough setting under the rubber dam. The filling is polished with strips and discs well vaselined, and after the filling is finished it should be well coated with melted paraffin.

To avoid discoloration of the cement in mixing and filling, Ascher has issued the following instructions for the manipulation of his "Artificial Enamel":

Discoloration is absolutely impossible if the enamel is rightly treated. If the material were at fault, every filling inserted would discolor—not an occasional one, as is generally the case. There are three reasons for discoloration existing.

First—The entering of foreign pigments or secretions into the filling. If the enamel is properly mixed and introduced under sufficient pressure, there is not the slightest porosity (as exact measurements have proven) and an intrusion of foreign matter is impossible. If, however, the material has been indifferently mixed and not properly condensed, it contains loose particles of powder that have not been compounded, and spaces which, in mixing, being pressed into the tough mass, are filled with air. The enamel is porous and liable to absorb foreign matter. To avoid this, mix quickly, incorporating all powder possible, until the mass curls from the slab when the flat side of the spatula is run lightly over it; then thoroughly mix with heavy spatulation to force out the air particles. Introduce under heavy

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pressure, for the same reason. If the pulp is nearly exposed, use cavity lining to avoid strangulation. As long as the material is plastic, everything coming in contact with it must be non-metallic and absolutely clean.

Second—If the surface of the filling is rough or poor margins exist, foreign pigments, which change the color of the whole tooth by deposits, will influence the surface and boundaries. The deposits of the pigments on a rough surface are much more intense and stay considerably stronger. The roughness is caused by using coarse strips and discs, by insufficient polishing, and by destroying the upper surface in cases where the filling is exposed to the saliva too soon. To avoid this, construct an exact and nicely finished margin. The filling must not come below the margin of the cavity. A very smooth, highly polished surface must be obtained, and there must be sufficiently long protection against saliva, so much more the thinner the enamel was mixed. Stir liquid thoroughly each time, discard residue of bottle, and keep rubber dam on for at least twenty minutes.

Third—The enamel in itself contains no substances which through any reaction could shape any pigment. It does contain pigments usually found in all silicates and other cements, and these are, of course, sensible to certain influences. Sulphureted hydrogen and proceeds of reduction can be observed as causes of darkening. But the forming of sulphureted hydrogen and proceeds of reduction are hardly possible, and one can scarcely attach much importance to them. Should they appear, however, they could only cause a superficial discoloration—"a slight indication"—which may be easily removed by a toothbrush or, eventually, by a little tooth powder. In this case a deeper or stronger discoloration is impossible.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

In the darkening of lingual fillings one thing must be observed. Discoloration of the surface in consequence of roughness is more liable here, as the lingual side of the teeth cannot be kept clean. In addition, in a mirror a filling always appears considerably darker on account of the optical difference of the tooth substance.

AMALGAM CEMENT.

Freshly mixed amalgam and oxy-phosphate of zinc cement, mixed to a thick creamy consistency, about equal parts, are thoroughly incorporated and inserted into the cavity.

OXYPHOSPHATE OF ALUMINUM.

Powder.

Aluminum powder..... 40 parts
Oxy-phosphate of zinc cement powder... 60 parts

Liquid.

Oxy-phosphate of zinc cement liquid.

OXYPHOSPHATE OF COPPER.

Powder.

Black oxide of copper..... 50 parts
Oxy-phosphate of zinc cement powder... 50 parts

Liquid.

Oxy-phosphate of zinc cement liquid.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

OXYPHOSPHATE OF GOLD.

Powder.

Precipitated gold powder..... 2 parts
Oxy-phosphate of zinc cement powder... 1 part

Liquid.

Oxy-phosphate of zinc cement liquid.

OXYSULPHATE OF ZINC CEMENT.

(Artificial dentine.)

Powder.

Powdered mastic..... $7\frac{1}{2}$ parts
Calcined zinc oxide.....100 parts
Calcined zinc sulphate..... 12 parts

Liquid.

Gum arabic..... 25 parts
Water ..... 65 parts
Alcohol ..... 10 parts
Liquid phenol..... 0.2 parts

OXYCHLORIDE OF ZINC CEMENT.

(Sorel's Dental Cement.)

1.

Powder.

Zinc sulphate, exsiccated..... 1 part
Zinc oxide..... 3 parts

Mix and calcine in a sand crucible at a red heat for about 10 minutes; remove, powder, and bolt through fine cheesecloth. Keep in well-stoppered bottles.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid.

Zinc chloride..... 50 parts
Water ..... 25 parts
Let stand for 24 hours and filter.

2.

Powder.

Powdered white glass..... 3 parts
Zinc oxide, calcined..... 9 parts

Liquid.

Borax ..... ½ part
Zinc chloride..... 20 parts
Hot water..... 6 parts

TIN CEMENT.

Powder.

Sponge tin powder (see page 71)..... 1 part
Oxy-phosphate of zinc cement powder.. 1 part

Liquid.

Oxy-phosphate of zinc cement liquid.

GUTTA PERCHA CEMENT FOR SETTING CROWNS, BRIDGES, ETC.

Aristol ..... 10 parts
Oil of eucalyptus..... 30 parts
Chloroform ..... 30 parts
Pink base plate gutta percha, enough to make a stiff paste.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CEMENT FOR REPAIRING CELLULOID.

The broken surfaces are brushed with a mixture of three parts alcohol and four parts ether, and as soon as the celluloid has softened the pieces are firmly pressed together. Instead of the alcohol-ether mixture the following solution may be employed:

Camphor	1 part
Shellac	5 parts
Alcohol	20 parts

Or,

Camphor	1 part
Shellac	1½ parts
Alcohol	30 parts

CEMENT FOR PORCELAIN, GLASS, ALABASTER, ETC.

(Diamond Cement.)

Isinglass	60 parts
Water	200 parts
Alcohol	20 parts

Cut the isinglass into small pieces and soak in the mixed liquids for 24 hours; apply gentle heat until fully dissolved.

Make a solution of

Gum ammoniac	10 parts
Alcohol	25 parts
Water	25 parts

and a solution of

Gum mastic	20 parts
Absolute alcohol	120 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Mix the gum ammoniac solution with the isinglass solution; boil and strain through flannel; add the gum mastic solution and evaporate on a water-bath until the whole weighs 240 parts, and pour in small wide-mouthed bottles.

To use the cement, place the bottle in hot water until the cement becomes liquid. Apply with a wooden stick upon the broken surface and tie together for 24 hours.

PULP CAPPING CEMENT.

Powder.

Calcium oxide	5 parts
Zinc oxide	95 parts

Liquid.

Solution of formaldehyde	½ part
Phenol crystals	5 parts
Eugenol	95 parts

CEMENT FOR HOLDING SMALL OBJECTS IN PLACE FOR FILING, ENGRAVING, ETC.

(Jeweler's Cement.)

Burgundy pitch	4 parts
Rosin	4 parts
Yellow beeswax	2 parts
Plaster of Paris	2 parts

Melt the pitch, rosin and wax over a low fire and stir in the plaster of Paris. Roll into sticks with wet fingers.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

RUBBER CEMENT FOR DENTAL BASE PLATES.

1.

Caoutchouc ..... 10 parts
Carbon disulphide, enough to make a thick liquid
Keep in well-stoppered bottles.

2.

Unvulcanized dental rubber..... 10 parts
Chloroform, enough to make a thick liquid.

LIQUID GLUE.

Best glue..... 50 parts
Water ..... 30 parts
Let stand over night; apply gentle heat until dissolved, and add to the hot solution:
Nitric acid..... 3 parts
Glycerin ..... 4 parts

PULP VARNISHES.

1.

Phenol, crystals ..... 1 part
Collodion ..... 10 parts
Yellow rosin..... 10 parts
Ether ..... 40 parts

2.

Gum mastic..... 2 parts
Balsam of Peru..... 2 parts
Chloroform ..... 6 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CAVITY VARNISHES.

1.

Select gum copal	50 parts
Ether	50 parts
Betanaphthol	5 parts
Dissolve, filter through a well-covered filter, and add enough ether to make the whole measure	75 parts

2.

Gum dammar	1 part
Rosin, light-colored	6 parts
Ether	4 parts
Alcohol	4 parts

3.

Gum camphor	6 parts
Gum copal	25 parts
Ether	50 parts

4.

Gum copal	2 parts
Acetone	3 parts

5.

(Carbolized Rosin.)

Rosin	4 parts
Phenol crystals	4 parts
Chloroform	3 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

TO PREPARE A CLEAR VARNISH.

The filtering of alcoholic varnishes is accomplished with many difficulties. A satisfactory clear varnish is readily obtained by thoroughly shaking the varnish with about 5 percent perfectly dry kaolin and setting aside in a warm place until the impurities have been carried to the bottom of the vessel by the heavy kaolin particles. Shellac varnishes are clarified by adding about 25 percent of gasoline to dissolve certain waxy compounds present in the shellac. The supernatent gasoline solution has to be drawn off from the transparent shellac varnish before the latter is ready for use.

CEMENT FOR STEAM FITTINGS.

Red lead ..... 4 parts
White lead ..... 10 parts
Powdered clay ..... 8 parts
Boiled linseed oil, enough to make a stiff paste.

TO CEMENT IRON TO IRON.

Pieces of iron can be cemented so firmly together as to withstand a blow of considerable force, by the following process, which is admirably adapted to the mending of cracked and broken iron mortars: Mix intimately six parts each of sulphur and white lead and one part of powdered borax. Wet the mass with strong sulphuric acid and apply at once a thin layer of it to the edge of each of the surfaces to be united. Bring the pieces together by strong pressure and leave them at rest, placing in such a position that they cannot fall apart.

In repairing a cracked mortar, insert, if possible, a thin wedge at the initial point of the crack, pushing it in care-

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

fully so as not to fracture the iron. Then place the cement in the crack, beginning at the lower end, and when the fissure is filled up remove the wedge. Now wind a few rolls of strong copper wire around the object and, with a pair of forceps, tighten the wire so as to bring the fractured edges into intimate contact. In a short time the joint will be as firm as any other part of the object.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER IV.

HARD AND FUSIBLE ALLOYS, SOLDERS, FLUXES, AMALGAMS, REFINING OF PRECIOUS METALS, TEMPERING OF METALS, METAL POLISHES, ETC.

ALLOYING OF GOLD PLATE OF VARIOUS CARATS.

(After William H. Dorrance.)

Pure gold may be alloyed for dental purposes with an alloy consisting of

Pure silver ..... 40 parts
Pure copper ..... 60 parts,

according to the following equation:

$$\frac{\text{Present weight} \times \text{present carat}}{\text{Required carat}} = \text{whole mass};$$

or, in figures, for making 18-carat gold,

$$\frac{100 \text{ grs.} \times 24 \text{ carats}}{18 \text{ carats}} = 18)2400 = 133\tfrac{1}{3} \text{ gr.} = \begin{array}{l} 100 \text{ grs. pure gold} \\ 20 \text{ grs. pure copper } (60\%) \\ 13\tfrac{1}{3} \text{ grs. pure silver } (40\%) \\ \hline 133\tfrac{1}{3} \text{ grs.} = \text{whole mass.} \end{array}$$

COIN GOLD.

An American ten-dollar goldpiece weighs 258 grains and is 21.6-carat fine. It consists of

---

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Pure gold	90 parts
Pure copper	9 parts
Pure silver	1 part

Various carat dental gold plate may be made as follows, according to the above formula:

18 Carat Gold Plate.

Coin gold	100 parts
Pure copper	9 parts
Pure silver	11 parts

19 Carat Gold Plate.

Coin gold	100 parts
Pure copper	$5\frac{1}{4}$ parts
Pure silver	$8\frac{1}{2}$ parts

20 Carat Gold Plate.

Coin gold	100.0 parts
Pure copper	1.8 parts
Pure silver	6.2 parts

22 Carat Gold Plate.

Coin gold	100 parts
Pure gold	75 parts
Pure silver	5 parts

GOLD ALLOYS.

14 Carats.

	Yellow	*Pale Red*	*Red*
Pure gold	14 parts	14 parts	14 parts
Pure silver	6 parts	3 parts	1 part
Pure copper	4 parts	7 parts	9 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

16 Carats.

	Yellow	*Red*
Pure gold	16 parts	16 parts
Pure silver	$4\frac{2}{3}$ parts	$1\frac{2}{5}$ parts
Pure copper	$3\frac{1}{3}$ parts	$6\frac{3}{5}$ parts

18 Carats.

	Yellow	*Red*
Pure gold	18 parts	18 parts
Pure silver	$3\frac{1}{2}$ parts	$2\frac{1}{2}$ parts
Pure copper	$2\frac{1}{2}$ parts	$3\frac{1}{2}$ parts

20 Carats.

Pure gold	20 parts
Pure silver	2 parts
Pure copper	2 parts

GOLD PLATE FOR SEAMLESS CROWNS; EVANS.

Coin gold	5 parts
Pure gold	$13\frac{1}{2}$ parts
Pure silver	$1\frac{1}{2}$ parts

CROWN GOLD; EVANS.

Coin gold	5 parts
Pure gold	9 parts
Pure silver	1 part

CLASP METAL; EVANS.

Pure gold	10 parts
Copper	2 parts
Silver	1 part
Platinum	1 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

SUBSTITUTES FOR GOLD.

1.

Copper	11.71 parts
Platinum	2.40 parts
Silver	3.53 parts

2.

Zinc	1 part
Copper	7 parts
Platinum	16 parts

SILVER ALLOY.

Pure silver	9 parts
Pure copper	1 part

ALLOYS FOR CHEOPLASTIC CASTINGS.

Lower Denture Alloy.

Gold	1 part
Silver	2 parts
Tin	20 parts

Samsioe's Alloy.

Platinum	$3\frac{1}{2}$ parts
Gold	$2\frac{1}{2}$ parts
Silver	29 parts
Tin	65 parts

Watt's or Weston's Alloy.

Silver	1 part
Tin	5 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ALUMINUM ALLOY.

1.

Silver	5 parts
Aluminum	95 parts

[*Note.*—Aluminum base plates should not be invested in plaster of Paris which has been mixed with salt water. Sodium chloride in the presence of organic or inorganic acids will destroy aluminum.]

2.

Copper	1 part
Silver	6 parts
Aluminum	93 parts

ALUMINUM BRONZE.

Copper	90 parts
Aluminum	10 parts

This alloy is used as a substitute for low-carat gold plate, and is extensively employed at present in the manufacture of regulating appliances. It possesses a color similar to gold, is tenacious, ductible and malleable, and melts at about 1800° F. It may be soldered with 16—18 carat gold solder. Clasps may be made from this bronze. They should be thoroughly annealed and very slowly cooled, so as to retain a strong spring temper.

DENTAL ALLOY.

Platinum	1 part
Silver	3 to 5 parts

It melts at about 1800° F. It is soft and pliable and in

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

many respects superior to pure silver. Dental rubber may be vulcanized to dental alloy without destroying its integrity. It may be soldered with 18 carat gold solder or with silver solder.

MAGNALIUM.

An alloy of aluminum with 10—15 percent of magnesium, having a specific gravity 2.4 to 2.6. It has a silver-white color, is tenacious and ductible, and is recommended as a superior substitute for aluminum intended for plate work. Magnalium plate, No. 20 gauge, has a tensile strength of about 30,000 pounds per square inch. Magnalium resists oxidation more readily than aluminum, and is almost unaffected by dry or damp air, water, gaseous ammonia, carbonic acid, sulphureted hydrogen, and most organic acids. The thermal conductivity of magnalium is much greater than that of aluminum.

VICTORIA METAL.

An alloy composed of copper, nickel and zinc. It is in many respects equal to aluminum bronze, but softer, and possesses no elasticity.

SPONGE TIN; SCHEURER.

A solution of pure stannic chloride is precipitated with pure zinc, and the resultant sponge-tin is thoroughly washed in boiling water, until free from all acidity, and dried in a drying-room. The sponge-tin appears as a gray felt, consisting partly of light, dustlike tin particles, partly of metallic fibers and scales. It is used for filling teeth much like moss-fiber gold. Pluggers as used for sponge-gold are advised for making fillings.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PLATINOID.

Copper	60 parts
Nickel	15 parts
Zinc	24 parts
Tungsten	1 part

ENGLISH "GERMAN" SILVER; BIRMINGHAM.

Nickel	72.00 parts
Silver	23.40 parts
Bismuth	4.20 parts
Gold	0.75 part

GERMAN SILVER.

Copper	60 parts
Zinc	25 parts
Nickel	15 parts

COMMERCIAL ALLOYS.

Bidery Alloy.

Zinc	31 parts
Copper	2 parts
Lead	2 parts

Magnolia Alloy.

Lead	40 parts
Antimony	$7\frac{1}{2}$ parts
Tin	$2\frac{1}{2}$ parts
Bismuth	$\frac{1}{8}$ part
Aluminum	$\frac{1}{8}$ part
Graphite	$\frac{1}{4}$ part

Gauge Alloy.

Copper	60 parts
Zinc	40 parts
Iron	$1\frac{1}{2}$ parts
Tin	1 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Alpaca Alloy.

Copper	40 parts
Zinc	32 parts
Nickel	8 parts

Alger Alloy.

Tin	90 parts
Antimony	10 parts

Argusoid Alloy.

Copper	55.5 parts
Zinc	23.2 parts
Nickel	13.4 parts
Lead	3.5 parts
Tin	4.0 parts

Ashberry Alloy.

Tin	80 parts
Antimony	18 parts
Copper	2 parts

Bibra Alloy.

Lead	40 parts
Tin	9 parts
Bismuth	8 parts

Boudoin Alloy.

Copper	72.0 parts
Nickel	16.6 parts
Cobalt	1.8 parts
Zinc	1.0 part
Aluminum	0.5 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Ruoltz Alloy.

Silver	20 parts
Copper	50 parts
Nickel	30 parts

Reetz Alloy.

Copper	15.00 parts
Tin	2.34 parts
Lead	1.82 parts
Antimony	1.00 part

LOW FUSION ALLOYS.

	Antimony	Lead	Tin	Cadmium	Bismuth	Melts at, deg. F.
Brophy's	0	$2\frac{3}{4}$	$2\frac{1}{2}$	0	3	240
Berry's	4	10	16	0	16	...
Crouse's	0	5	5	1	8	190
Erman's	0	1	1	0	2	199
Harper's	0	4	4	1	7	180
Hodgen's	2	5	3	0	8	224
Melotte's	0	3	5	0	8	205
Merck's	0	25	25	20	55	162
Molyneau's	0	3	2	2	5	140
Newton's	0	2	3	0	5	212
Richmond's	0	5	3	0	8	202
Rose's	0	8	3	0	8	203
Simpson's	0	19	20	13	48	...
Wood's 1.	0	4	2	1	7	158
Wood's 2.	0	20	40	26	96	135

Note: The metals have to be melted according to the above arrangement, i. e., melt the antimony first, when completely melted, add the lead, then the tin, then the cadmium and finally, under constant stirring (with a low flame) the bismuth.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

LOW FUSING ALLOYS FOR VALVE PLUGS.

Melting Point °F.	Lead	Tin	Bismuth
212	125	125	75
257	100	100	100
293	200	200	100
311	280	300	50
335	200	240	50
347	300	200	50
374	100	100	0

DIE- AND COUNTER-DIE METALS.

Die Metals.

	Copper	Antimony	Zinc	Tin
1.	3	0	39	8
2.	6	3	48	10
3. (Haskell's)	1	2	0	8

Counter-Die Metals.

	Lead	Tin	Bismuth
1.	4	1	0
2.	3	1	2
3. (Haskell's)	5	1	0

BABBITT METAL; HASKELL.

This is the only metal having all the fine requirements for a dental die, which are (1) non-shrinkage; (2) hardness, so as not to batter; (3) toughness, so as not to break; (4) a smooth surface; (5) melting at a low temperature. The proper formula is copper, 1 part; antimony, 2 parts; tin, 8

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

parts; melting in the order named. Do not overheat, as it will oxidize the tin.

SPENCE METAL.

(Invented by Berger Spence, London.)

Sulphur	1 part
Native iron pyrites, in very fine powder	2 parts

Melt the sulphur in an iron or earthenware pot and stir in the pyrites. Spence metal melts at about 260° F.; it is very hard and contracts slightly on cooling. It gives sharp impressions and may be cast into oiled plaster of Paris impressions. It is largely used as a die metal in the dental laboratories of England and on the European continent.

SOLDERS.

Gold Solder Alloy; Dorrance.

Pure silver	1 part
Pure zinc	2 parts
Pure copper	3 parts

The silver and copper are melted together in a sand or graphite crucible lined with borax; the zinc, wrapped in tissue paper to prevent oxidation, is quickly thrust into the molten mass and the whole is stirred together with a clay-pipe stem held in a pair of tongs. To prepare solder, melt one part of this alloy with seven parts of clippings of the gold plate under construction.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

GOLD SOLDERS.

1.

	For 14 carat gold	16 carat gold	18 carat gold	20 carat gold
Coin gold.....	13	15	17	19
Silver	7	5	4	4
Copper	3	3	2	2
Brass*	1	1	1	1

2.

Melt together from five to seven parts of scraps of the gold plate under construction with one part of brass pins.

3.

LOW FUSING GOLD SOLDER.

14 carat gold solder.....	1 part
Silver solder.....	1 part

GOLD SOLDERS MADE FROM COIN GOLD.

For 20 Carat Gold Plate.

$5.00 gold piece
15 grains cadmium.

For 18 Carat Gold Plate.

$5.00 gold piece
16 grains copper
16 grains cadmium

* English brass pins furnish a good quality of brass for such purposes.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

For 14 Carat Gold Plate.

$5.00 gold piece
16 grains silver
48 grains copper
16 grains cadmium

5.

Gold Solders; Zinc Type.

	For 14 carat gold	18 carat gold	20 carat gold	22 carat gold
Pure gold	50	65.5	73.7	82.5
Pure silver	26	19.0	12.0	8.0
Pure copper	18	10.0	9.1	4.3
Pure zinc	8	7.0	7.0	7.0

6.

Gold Solders; Zinc-Cadmium Type.

	For 14 carat gold	16 carat gold	18 carat gold	20 carat gold
Pure gold	57.5	65.0	74.0	82.3
Pure silver....	13.0	9.5	6.5	3.8
Pure copper....	22.0	18.0	12.0	8.3
Pure zinc.....	1.8	1.8	1.8	1.8
Pure cadmium..	12.0	10.5	10.0	8.5

Small crevices, holes, etc., may be easily covered with solder by first filling these cavities with sponge gold.

PLATINUM SOLDER.

Platinum ..... 25 parts
Gold ..... 75 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

IRIDIO-PLATINUM SOLDER.

1.

Use Platinum Solder.

2.

Watt's Crystal Gold and Platinum makes an easy flowing 10 percent platinum solder for uniting the frame-work in inlay—crown—bridge—or continuous gum work. It flows almost as easily as pure gold. It should be used with a flux. (W. L. Fickes).

SILVER SOLDERS.

1.

Pure silver	6 parts
Pure copper	3 parts
Pure zinc	1 part

2.

Coin silver	90 parts
Zinc	10 parts

3.

Pure silver	12 parts
Brass (English brass pins)	5 parts

4.

Pure silver	12 parts
Brass (English brass pins)	6 parts

SOLDER FOR NICKEL OR GERMAN SILVER.

Use Silver Solder.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ALUMINUM SOLDER; MONREY.

	1.	2.	3.
Tin	80	85	88
Copper	8	6	5
Aluminum	12	9	7

SOFT SOLDER.

	Low	Medium	High
Lead	2	1	1
Tin	1	1	2

FLUXES.

For Hard Soldering.

1.

Calcined borax ..... 1 part
Yellow vaseline..... 2 parts
Rub up in a mortar into a uniform, smooth paste.

2.

Borax ..... 16 parts
Boric acid..... 8 parts
Ammonium chloride..... 4 parts
Potassium carbonate..... ½ part
Hot water.....125 parts

3.; Dodel.

Borax ..... 7 parts
Boric acid..... 7 parts
Distilled cold water..... 50 parts
Shake, until dissolved.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

4.

Calcined borax	4 parts
Calcined sodium chloride	3 parts
Calcined potassium carbonate	2 parts

5.

Calcined borax	7 parts
Ammonium chloride	1 part

6.

Phosphoric acid, U. S. P.	5 parts
Water	5 parts
Alcohol	5 parts

For Soft Soldering.

1.

Dental cement liquid (Phosphoric acid.)	1 part
Alcohol	1 part

2.

Zinc	5 parts
Hydrochloric acid	10 parts

Dissolve, and, after reaction has ceased, add

Ammonium chloride	3 parts
Water	10 parts

3.

Pieces of zinc are dissolved in hydrochloric acid until the acid is saturated. The resultant solution of zinc chloride is mixed with an equal amount of a mixture of water of

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ammonia and alcohol. After standing a few days the solution is filtered and is then ready for use.

4.

Zinc chloride	2 parts
Water	4 parts
Alcohol	4 parts

5.

Rosin	45 parts
Suet	45 parts

Melt, and add, with constant stirring

Ammonium chloride	10 parts

FLUX FOR SOLDERING ALUMINUM.

Stearic acid	80 parts
Zinc chloride	10 parts
Tin chloride	10 parts

SOLDERING FOR REPAIRING BROKEN METAL, FINE INSTRUMENTS, ETC., WHEN HEAT WOULD BE INJURIOUS.

(Cold Solder.)

Flux—Metallic sodium	1 part
Mercury	50 parts

(Keep in glass stoppered bottle.)

Solder—Silver	8 parts
Tin	10 parts
Bismuth	1 part
Platinum	1 part

Melt together, cast in an ingot and rasp to filings. Mix filing, 3 parts, and flux, 1 part, to a smooth paste when

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

about to use. Omitting the bismuth gives a granular mass suitable for filling crevices; omitting the platinum reduces the strength and requires an hour to harden.

THE MANUFACTURE OF DENTAL AMALGAM ALLOYS.

(N. K. Garhart.)

The metal formulas of all dental amalgam alloys that are usually found on the market are composed of two or more of the following four metals: silver, tin, copper and zinc. Silver, tin and copper are the metals most commonly used, although zinc in conjunction with these three is becoming more frequently used. Gold and platinum are not used to any appreciable extent. Only minute traces of these metals can be found in the so-called gold and platina alloys. It is not the expense of making the alloy that concerns the average manufacturer, but the expense of marketing his products precludes the use of such expensive metals. Simple silver and tin formulas are rarely used nowadays. The test of time has proven that such simple formulas make very poor alloys. Copper and zinc have an effect of controlling the shrinking factor of an alloy, also hastening its setting properties. That copper toughens and increases the edge-strength has been known for many years. It also is well known that it causes discoloration when present in large quantities. Aluminum, bismuth and antimony have been exploited for the purpose of adding some special virtue to alloys. I must admit that I have never found any advantages in using any of these metals. Alloys containing appreciable amounts of bismuth and antimony discolor the hand to an unusual degree while aluminum can never be used in quantities beyond one percent. If larger amounts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

of aluminum are used the amalgam will suddenly decompose, setting free the mercury and converting the other metals to oxides. Various forms of bronze have been suggested for imparting a beneficial action to alloys. My observation and experience has been that such beneficial results are mainly due to copper, which constitutes about 80 to 90 percent of the bronze. Most amalgam authorities claim that silver is the expanding element and tin the contracting element of all amalgamating alloys. Hereinafter my experiments will prove that this is not altogether true.

We have heard a great deal of discussion in regard to the so-called white alloys, and the question is daily asked us if our alloy will maintain its color indefinitely in the mouth. Since I believe that the discussion of color should come under the head of formulas, I propose to dispose of this matter now. Amalgams either oxidize or sulphidize in the mouth. I actually believe that most of the discoloration is due to oxidation. We all know that any form of gold under 18k will rapidly discolor in the mouth; hence if it requires pure gold from 80 to 90 percent fine to prevent discoloration, why should it not require the same amount of gold to prevent amalgam from discoloring? You will readily appreciate the fact that it is impossible to use such a high percentage of gold, and experience has proven that even 15 percent of gold will not prevent discoloration in amalgam fillings. Of course manufacturers say that they make alloys that will not discolor, but you may believe as much of this story as you wish. We know that some alloys discolor more easily than others. You can always attribute this cause to the presence of too much tin or copper and sometimes both metals. The reason why a great many alloy fillings retain their bright color in the

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mouth is due to the constant polishing that they receive from the mastication of food. You cannot attribute the retention of color to any other cause, inasmuch as minute quantities of other metals and special methods of preparing the alloy will not protect the amalgam from discoloring. In chemistry we have certain fixed and immutable laws which are beyond the control of man.

It is common belief that the smelting of alloys is a simple procedure. All that is required is a crucible, the metals, some borax and a furnace in which we are to liquify the metals with heat. To the competent metallurgist the proper smelting of alloys is not a difficult proceeding. That it requires technique and skill is perfectly true. Not all formulas are melted alike; hence a full knowledge of the chemistry of metals is required. Most metals have a great affinity for oxygen when in a molten state, and some of them are volatile at certain temperatures. To preserve the integrity of the formulas so that loss due to volatilization and liquation, or separation of the metals will not occur during the smelting and pouring process are a few of the important features to which the metallurgist must give careful attention. In regard to the furnace work I will say that the gas and air must be under perfect control. This requires the use of delicate regulators. Both gas and air should be under pressure and so proportionately mixed as to always maintain a deoxidizing atmosphere in the furnace. Powdered carbon as a preventative for oxidation is far preferable to borax. If by any accident some of the molten mass should oxidize, borax will dissolve the oxides, while carbon will reduce them to the metallic state. Carbon has a greater affinity for oxygen than that possessed by any of the metals most commonly used for amalgam purposes.

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It is quite necessary that the metals must be treated in the furnace for some time so that their chemical union may be completed. Graphite crucibles are most generally used for holding the metals. The use of crucible covers is necessary for preventing oxidation during the smelting process. Simply liquifying the metals, stirring and pouring them will not produce a homogenous product. The use of iron rods for stirring should be abandoned, and compressed carbon rods substituted in their place. Molten alloy will dissolve iron, and it will also attack the ingot mould, which is usually made from cast iron. The ingot moulds should be covered with a thin film of carbon, which is readily accomplished by smoking it over a coal-oil flame. I have always considered it a wise policy to smelt each ingot separately, and so have my furnaces designed to hold a number of small crucibles.

The cutting process is the method employed for reducing the ingot to a fine state of division, so that the alloy will readily combine with mercury. This process is one of the most important branches of this industry. Most makers cut or shave their alloys on an ordinary lathe. The lathe tool is usually fed by hand. The self-feeding mechanism of an ordinary lathe is entirely too coarse for this purpose. Five years ago I abandoned the hand process of cutting alloys, and had designed for my use a special machine provided with an automatic tool-feeding mechanism.

The filing process is not a scientific way of cutting alloys. The filings are not uniform and there is no method for sharpening the file. A cylindrical file is generally used, and because of their great expense they are used until they are well worn out. When the file is new small particles of steel break off with the alloy. These steel particles must

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be carefully removed with the aid of an electro-magnet. It requires but a short time for the file to become dull; hence the alloy thereafter is torn off by friction. Since heat is a product of friction, it is very apparent that filings take up oxygen from the atmosphere.

The shaving method requires the use of keen-edged tools, and is by far the most scientific way to cut alloys. The tools are sharpened from time to time, thereby producing a clean and even cut. The finest grade of steel is employed and they are carefully tempered to the required degree of hardness, in keeping with the character of alloy to be cut. Alloys containing large quantities of copper and silver are very brittle. The quick-setting alloys are so brittle that they are very difficult to shave. They are usually cut in the form of a needle-like shaving. In this state they combine more readily with mercury than when they are in a flake-like form.

The failure of a manufacturer to imitate another's product is not due to the formula, but to the cutting process. Chemical analyses will reveal the exact metal formula of any alloy. It is not the formula but the exact method of cutting that bothers imitators. So it will be observed that the personality of the alloy can be readily changed by the cutting process. We may take two alloys of the same formulas, one cut in thin shavings, and the other in thick ones. They will mix and set so differently that the average practitioner would conclude that they were widely different from each other in formula. It is this variation in the thickness of the shavings that has a wonderful influence upon shrinkage, expansion, edge-strength and setting factors of an alloy. The hand method of feeding the tool in cutting alloys will always produce an un-uniform pro-

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duct. Amalgams made from such alloys will always show variable results in the mouth.

The annealing process is the means employed by various manufacturers for artificially aging their alloys. Dr. Black advanced the idea of heating fresh cut alloys for several days at a temperature of 120 degrees F. Other investigators have since shortened the length of time required for artificially aging by using boiling water. The various makers of thick-setting alloys claim that their products will not change from further aging. These claims are distinctly false and misleading. All quick-setting alloys will set slower after they have stood in your office for one year. These alloys are only partly annealed and very slightly so at that. Any quick-setting alloy can be annealed so as to be extremely slow-setting if subjected to the boiling water process for a considerable length of time. Fresh quick-setting alloys when properly cut possess several points of expansion. The annealing process will remove this expansion; hence they are treated until they only show from ½ to 1 point of expansion. So you will note that quick-setting alloys are only partly annealed, and they will change when left in your office for any length of time.

The manufacturer is in a better position to judge of the merits of alloys than the average dentist. He has the entire clinical experience of his trade to rely upon and he gains much valuable information from his competitor's trade as well. The old saying that "two heads are better than one" aptly applies to this case.

The question of testing alloys is one which has concerned the dental profession ever since amalgams first came into practical use. The results that I have obtained from using the micrometer have led me to believe that it

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is the only reliable and accurate means for determining the preserving properties of amalgam fillings. I do not wish to ignore the "test of time," nor do I care to ignore the great number of cases of faulty manipulation upon which a great number of these tests have been unconsciously based. As far as the accuracy of the micrometer is concerned, it has proven conclusively that alloys which show the best results on this instrument always give the best results in the mouth. It records every particle of shrinkage and expansion with great delicacy and accuracy. Fillings made from slightly expanding quick-setting alloys will not fail in the mouth. Should a failure happen you can safely attribute the cause to faulty manipulation, or preparation of the cavity, or else to a condition of the tooth structure, which must be of such a degenerate character that it could not be saved by any artificial means.

According to my estimation the glass tube test is a very unreliable and inaccurate method for ascertaining the tooth-preserving qualities of amalgam. The walls of any artificial matrix should compare favorably with those of the dentine. The walls of the tooth are left rough by the action of the bur, and thus afford an ideal surface for an amalgam or a crystaline compound to adhere. Amalgams are nothing more than metal cements, of which the copper and the silver are the hardening agents. Take any cement which does not leave a polished surface and it will not adhere to a polished surface like that of glass. Portland and lime cements will not adhere to glass, but when applied to any roughened material like brick the adhesion is complete. The greatest obstacle in the way of properly filling a glass tube with amalgam is the removal of excess mercury. There is no mechanical method for securing

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the tube so that the proper pressure can be applied to condense the filling in place. Only a downward pressure can be exerted which forces the mercury to the inner walls of the tube. This surplus mercury is reabsorbed again after your work has been completed, thereby producing shrinkage, especially at the periphery of the filling. Lateral pressure is necessary to force the dry amalgam to the periphery of the filling. The existence of these grave faults in using this test no operator can deny. I consider any test unreliable that cannot be duplicated with some degree of accuracy. It is impossible to fill six tubes with the same make of alloy and obtain the same results in all cases.

I firmly believe in the microscope for examining margins. The best plan is to photograph your work from month to month. These photographs are your records of any changes that might have occurred.

The flow and the crushing tests of alloys are of no practical importance, inasmuch as these factors are amply great enough in all alloys. It is an easy matter to make a poor alloy with a good edge strength. Spheroiding or changing of form is nothing more than excessive shrinkage. This condition of affairs can be directly attributed to faulty manipulation of the alloy. Dr. Black could have given some valuable information on this subject had he submitted some spheroidal fillings to a chemical analysis. Had the quantity of mercury been estimated, he could have proven the presence of surplus mercury. An alloy containing as low as 45 percent silver when properly manipulated and inserted in the cavity will not flow to an appreciable degree. Nearly every high grade alloy will stand any strain that masticating stress can impose upon it.

Dr. Black deserves great credit for presenting the

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practical utility of the micrometer to us. It certainly fills a long-felt want, and affords a scientific means for standardizing our products without relying upon the conflicting data that we are in the habit of receiving from our trade. I have compiled some important tests which will throw some light upon the subject of alloys. Before presenting these tests to you I desire to call your attention to some conclusions of Dr. Black's work. He stated that it was impossible for the manufacturer to produce an alloy which would give uniform results from any set formula. At the time that he made these statements there was a great deal of truth in his remarks, and it was that which led me to take up this work of investigation. It occurred to me that we should look for some fault in our smelting, annealing or cutting processes as being the probable cause of variation in our finished product. My theory has been, if like conditions prevailed throughout the entire process of making alloys that like results would always be obtained. I will afterwards prove that this fault was mainly due to a variation in the thickness of cut, as a result of using the hand process of cutting our alloys. This variation in the thickness of cut produced a like variation in the shrinking and expanding factors of the resulting amalgam. It was for this reason alone that I adopted the use of a special automatic machine for cutting my alloys.

There is one more thing that Dr. Black stated which did not seem practical to me. He claimed that filed alloys gave better results than the shaved variety. He never presented a scientific explanation of this assertion. Had he carried his investigations further he would have found that filed alloys are coarse cut products, while the shaved alloys were invariably cut very thin at the time that he made his

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experiments. When he was carrying on these experiments, the various makers of alloys were in the habit of cutting their alloys in extremely thin shavings, which were very popular with their trade. Had alloys been cut in much thicker shavings there would have been no difference in his results.

Having called your attention to these important facts we will carefully compare the results of my tests of various formulas with them. Each formula was annealed for 15 minutes in boiling water, and they were cut in four different thicknesses of shavings. No. 1 cut is the thinnest. The others are progressively 25 percent thicker. The test plugs of amalgam measured ¼ inch in diameter and ¼ inch in depth. They weighed 2.3 grammes, or about 35.5 grains. The fillings were inserted in a hardened steel matrix or tube. The alloy was carefully weighed and mixed with an exact quantity of mercury sufficient to produce a stiff plastic mass. The usual precautions were taken in regard to wafering the amalgam, and these tests were made under the same conditions, so far as it was within my power to accomplish it. Each sample was subjected to a 24 hour test, and usually after the sixth hour no further movement could be detected.

FORMULA NO. 1.

Silver 45, copper 10, tin 45 percent.

Shrinkage, cut 1—9.5
2—7.5
3—6.5
4—4.5 points

No. 1 required equal parts of mercury and alloy; No. 2, 1.4 parts mercury to 1.5 parts alloy; No. 3, 1.3 parts mer-

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cury to 1.5 parts alloy; No. 4, 1.2 parts of mercury to 1.5 parts of alloy.

FORMULA NO. 2.

Silver 50, tin 45, copper 5 percent.
Shrinkage, cut 1—14.5
2—11.5
3— 7.5
4— 6.0 points

Proportions of mercury and alloy required were the same as in formula No. 1.

FORMULA NO. 3.

Silver 55, tin 40, copper 5 percent.
Shrinkage, cut 1—11.5
2—10.5
3— 7.0
4— 5.0

Proportions of mercury and alloy same as in No. 1 formula.

FORMULA NO. 4.

Silver 60, tin 38, copper 1, zinc 1 percent.
Shrinkage, cut 1—8.5
2—7.0
3—5.5
4—3.0

Proportions of mercury and alloy used same as in No. 1 formula.

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FORMULA NO. 5.

Silver 68, tin 32 percent.
Shrinkage, cut 1—12.0
2—10.5
3— 8.0
4— 4.5

Portions of alloy and mercury used were 5 of alloy and 6 of mercury for 1 and 2, equal parts for 3 and 4.

FORMULA NO. 6.

Silver 68, tin 28, copper 2.5, zinc 1.5 percent.
Shrinkage, cut 1—3.5
2—2.0
Expansion 3— .5
4—1.5 Points

Proportions of mercury, 7 of mercury and 5 of alloy for 1 and 2; 6 of mercury and 5 of alloy for 3 and 4.

FORMULA NO. 7.

Silver 60, tin 35, copper 5 percent.

Only No. 4 cut measured. Shrinkage 3.5 points. Mercury 1.2 to 1.5 of alloy.

We will see what these tests prove in regard to formulas. Your attention is called to the various cuts of No. 1 formula. Carefully compare these shrinking factors with those of Nos. 2, 3 and 5. You will note that the shrinking factors are much less in No. 1 formula than in Nos. 2, 3 and 5. The silver factor of Nos. 2, 3 and 5 formulas is much higher than that of No. 1, and yet the former alloys

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show a greater percentage of shrinkage. The shrinkage factors are greater with one exception, and that is the No. 4 cut of No. 5 formula. If silver is the expanding element, and tin the contracting element, then formulas 2, 3 and 5 should show the best results. Your attention is next called to the percentage of copper in Nos. 2 and 3 formulas. It will be seen that it is just 50 percent less than the amount contained in No. 1 formula. It is quite evident that copper overcomes shrinkage to a wonderful degree. While silver possesses this property, it may be regarded that the combination of the two metals are the elements of an alloy. Let us compare the shrinking factor of No. 4 cut of formula No. 1 with that of No. 4 cut of formula No. 7. The results show us that there is 1 point in favor of No. 7. The percentage of copper is 50 percent less in No. 7 than in No. 1. The silver required to overcome this reduction is three times that of the copper, or just 15 percent. These results prove to us that the expanding influence of the copper is much greater than that of the silver. Your attention is called to No. 5 formula. Please note the very high percentage of silver that it contains. This formula contains no copper in its composition. It carries just 23 percent more silver than No. 1 formula. A careful comparison of the shrinking factors of the No. 5 formula with that of No. 1, and including the shrinking and expanding factors of formula No. 6, will prove conclusively that simple tin and silver combinations are the worst formulas that any manufacturer can use. We will now compare the shrinkage factor of No. 4 cut of formula No. 7 with that of No. 4 cut of formula No. 4. It will be seen that the results are slightly more favorable for the No. 4 formula than for the No. 7. You will particularly note that No. 4

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formula only contains 1 percent each of copper and zinc, while No. 7 formula contains full 5 percent copper. Summing up these results, we are led to believe that a four-metal formula is the best that any manufacturer can adopt for his alloy. By using such a formula the percentage of copper can be greatly reduced simply by the addition of a small percentage of zinc. The four-metal formula eliminates the factor of rapid discoloration of the amalgam, since only a small percentage of copper is required when zinc is employed. So it will be seen that the manufacturer is confined to the use of these four metals for the formulas of his medium-priced alloys, since the extremely high price of gold and platina metals precludes their use entirely.

These tests prove that the quick-setting formula is the best tooth preserver. You will recognize No. 6 formula to be Dr. Black's, and which is used by all makers of quick-setting alloys. Owing to its very quick-setting features this amalgam has never been very popular. In a great many instances have fillings failed that were made from quick-setting alloys. The lack of edge-strength and crumbling nature of these fillings proved conclusively that they had failed due to premature setting or crystallization of the amalgam. Many operators are in the habit of working the soft amalgam in the palm of the hand to prevent it from setting. In many cases they carry this operation too far, and the result is a filling which soon crumbles to pieces. As a matter of precaution, where large fillings are to be inserted it is the best policy to make two mixes when using quick-setting alloys.

All medium and slow-setting alloys produce slightly shrinking amalgams. The very best medium-setting alloys average from 8 to 16 points shrinkage. My experiments

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have aided me in producing a medium setting, 60 percent silver alloy, having from 2 to 3 points of shrinkage.

By carefully annealing my 68 percent silver formula I have produced a medium-setting alloy that will show neutral results on the micrometer. I have yet to find other medium-setting alloys that will show such efficient results.

Again referring to my tests, you will note that for each increase in the thickness of shaving there is a corresponding decrease in the shrinkage factor of the amalgam. You must bear in mind that there is a limit to the cutting process and that No. 4 cut is entirely too coarse for quick-setting alloys. Less mercury is required to make a perfect mix of the No. 4 cut than for the No. 1. When wafering the amalgam, more mercury can be expressed from cut No. 4 than from cut No. 1. These facts account for the greater amount of shrinkage in the thinner shaved alloys. It all depends upon the nature of the formulas as to how thick the shavings should be cut.

In conclusion, I will state that it is impossible for any manufacturer to better his product without the use of the micrometer. This delicate instrument is just as necessary to the alloy maker as the Analytical Balance is to the chemist. Every batch of alloy should be standardized, and the micrometer is the only practical instrument for this purpose. They are regarded as an expensive luxury by most manufacturers, therefore they have not come into general use.

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MODERN AMALGAM ALLOYS.

	Silver	Tin	Copper	Zinc	Gold	Platinum
Acme	65.00	29.00	5.00	1.00	...	...
Ash & Son's	66.54	27.16	5.02	0.9	...	...
Black's	68.5	25.5	...	1.00	5.00	...
Davis'	42.41	51.42	3.21	...	3.2	...
Eureka	55.00	40.00	3.00	2.00	...	...
Fellowship	67.71	27.95	3.18	1.16	...	...
Fidelity	67.76	26.30	4.71	1.23	...	...
Flagg's submarine	60.00	35.00	5.00	...	...	...
Flagg's contour	64.00	32.00	...	...	4.00	...
Fletcher's	40.00	56.00	...	...	4.00	...
Gibraltar	68.50	25.50	5.00	1.00	...	...
Globe	44.89	51.90	...	.50	2.71	...
Hedstrom's	66.00	27.00	5.00	2.00	...	...
Herbst's	53.85	38.46	...	...	7.69	...
Hodgen's	53.00	42.3	4.7	...	...	...
Justi's Superior	35.20	69.10	3.50	1.80	.32	0.8
Lawrence's	44.06	50.43	5.51	...	...	...
Lorenz's	49.79	48.87	.70	...	.37	...
Odontographic	66.87	26.48	6.21	...	.28	...
Micrometric	67.14	26.64	4.31	1.91	...	...
Rego	66.54	28.14	4.21	1.06	...	...
Sauer's	41.67	50.00	...	...	8.33	...
Skogsborg's	56.00	40.00	...	...	4.00	...
Sterion	61.89	31.85	4.16	2.10	...	...
20th Century	67.03	27.13	4.87	1.10	...	...
True Dentalloy	65.91	27.13	5.21	1.52	...	...
Welch's	46.00	51.90	...	...	1.70	.40
Witzel's	53.00	40.00	5.00	...	2.00	...
Zsigmondy's	50.00	33.33	...	...	16.67	...

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COMPENSATION AMALGAM ALLOY.

(A. Fenchel.)

1.

Silver	55 parts	Cut into fine filings
Tin	45 parts	
Copper	3 parts	

2.

Silver	40 parts	Cut into fine filings
Tin	55 parts	
Copper	3 parts	

3.

Silver	50 parts	Cut into coarse filings
Tin	45 parts	
Platinum	2 parts	
Gold	3 parts	
Zinc	3 parts	
Copper	3 parts	

Mix the above cut alloys without further melting according to the following formula:

No. 1.....	3 parts
No. 2.....	3 parts
No. 3.....	1 part

TO PREVENT AMALGAMATION OF GOLD IN THE MOUTH.

Coat the gold with a quick-drying mastic- or sandarac varnish.

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REFINING OF PRECIOUS METALS.

The refining of precious metals requires an intimate chemical knowledge and an extended experience with the various methods involved. To refine small quantities of gold, silver or platinum is not a profitable process for the busy dentist. It is far more economical to collect the precious metal scraps, fillings, etc., until a hundred dollars' worth are accumulated. They may then be melted and sent to a United States sub-treasury, which in due time will remit a check representing the actual value of the material, or the gold may be sold to a reliable refiner.

The refining of gold in the dental laboratory may be successfully carried out by a number of methods, of which the following are especially adapted to the needs of the practitioner. The dry method, the quartation method, and the wet method are available for this purpose.

The Dry Method.

1. Remove particles of plaster, wood, base metals, platinum pins, etc., from the scraps.

2. Pass a magnet through the scraps to remove iron particles.

3. Wash the gold scraps in boiling water and dry them upon filter paper.

4. Place the scraps in a crucible lined with borax, and cover with a mixture of three parts of borax and one part of saltpeter. Heat and keep in a molten state for half an hour, adding small amounts of sal ammoniac from time to time. Stir thoroughly with a compressed carbon rod (electric light carbon) and pour into a suitable ingot mold. If the gold is still too brittle when passed through the rolling mill, certain base metals have not been fully removed.

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The gold is again melted and small quantities of mercuric chloride (corrosive sublimate) are added. Extreme care should be exercised not to inhale the very poisonous fumes of the sublimate. The dry method of refining gold produces good results if the gold scraps are fairly uniform in character; platinum and iridium remain unchanged in the gold, while all the base metals are removed as oxides or chlorides. A few Dixon black lead crucibles, a small Fletcher injector furnace, and a hood to carry off the fumes, constitutes the simple outfit. Very small quantities of gold scraps may be fairly well refined by employing the above process upon a piece of charcoal, using a good compound blow-pipe for melting the gold.

The Quartation Method.

It consists in melting the gold scraps with about three times their weight of pure silver; the alloy is poured into a bar ingot mold and the cast ingot is rolled out into thin ribbons. These ribbons are then coiled in a spiral and placed into hot commercial sulphuric acid. The silver and base metals are dissolved and the gold remains in a porous mass which, after washing in water, may be melted and poured into molds. Platinum and iridium are not removed by the quartation method. The gold produced in this way is about 995 percent pure.

The Wet Method.

Not less than one ounce of gold scraps or precipitated waste gold should be used in refining by the wet method. To prepare waste gold for refining, precipitate the waste gold solution with iron sulphate, dissolved in water. Eight parts of the washed and dried sediments are mixed with

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Potassium carbonate	4 parts
Sodium chlorate	2 parts
Powdered common bottle glass	2 parts

Place in a crucible and melt. Stir with a compressed carbon rod and pour into a mold.

Gold scraps for refining by this method are prepared as outlined in the dry method.

Place an ounce of the prepared gold in a porcelain dish and cover it with aqua regia; four ounces of the acid are required for each ounce of gold. Aqua regia for such purposes should be freshly prepared by mixing one ounce of nitric acid with three ounces of hydrochloric acid; only C.P. acids are to be used. Place the dish in a sand-bath and apply heat until the gold is dissolved. Care should be taken to allow the poisonous fumes to be carried off, as they are dangerous to the health of the operator and especially destructive to metal instruments, etc. Decant the clear solution from the sediment, evaporate it to a syrupy consistency, and carefully add, with constant stirring, about one-half ounce of hydrochloric acid. Again heat until the acid is removed. Dilute the solution with one-half gallon of distilled water, heat for an hour, and set aside for twenty-four hours to allow the freshly formed silver chloride to settle. Filter through paper into a large glass bottle and wash the remaining silver chloride three or four times with hot distilled water, running the washings into the original filtrate. Add to the contents of the bottle one and one-half ounces of ammonium chloride, shake well until dissolved, and set aside for twenty-four hours. Any platinum present is precipitated as platinic sal ammoniac.

The liquid is now filtered through a wet paper filter and the remaining platinic sal ammoniac is washed with a

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pint of boiling distilled water to which two drachms of sal ammoniac have been added. The whole precipitate is now poured into the filter and the liquid is drained off.

To precipitate the gold from the solution, oxalic acid, sulphurous acid, ferrous sulphate, and other chemicals are used. Iron sulphate is well suited for working with small quantities. For every ounce of the original gold, four ounces of ferrous sulphate are required. The iron sulphate is dissolved in a pint of distilled water and filtered into the gold solution; the gold will be precipitated in the form of a brown powder. About twenty drops of hydrochloric acid are added, the bottle is vigorously agitated and set aside for twenty-four hours to allow complete precipitation. The gold magma is now filtered through paper and repeatedly washed with hot distilled water. After the filter containing the gold has become perfectly dry, it is placed in a crucible, covered with a mixture of two parts of borax and one part of saltpeter, and heated until the gold becomes fluid, and it is then poured into a suitable ingot mold which has been previously slightly oiled and heated.

To recover the silver, place the dry filter containing the silver chloride in a crucible and cover with a mixture of six parts sodium carbonate and one part powdered charcoal; heat until the silver becomes fluid, and then pour into a suitable ingot mold which has been previously slightly oiled and heated. After melting, the silver will be found in the bottom of the crucible.

Platinum is recovered from the platinic sal ammoniac by burning the dried filter in a porcelain capsule. The capsule is subjected to a slow continuous red heat until all ammonium chloride is driven off. The platinum will remain in the form of a grayish black mass, known as platinum

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sponge. The platinum sponge is now melted on a piece of soft charcoal with the oxy-hydrogen blow-pipe into a bottom of pure platinum.

REFINING OF MERCURY.

I.

Two pounds of mercury are placed in a strong bottle with four ounces of water and one ounce of ferric chloride solution and mixed by agitation until the mixture becomes a grayish magma. Let stand in a cool place for two to three days, remove the watery portion, wash the mercury with diluted hydrochloric acid and hot water until it assumes a bright color. Dry the mercury by placing a few thicknesses of filter paper in a large porcelain dish, pouring the mercury over it and repeating the operation two or three times. Finally run the mercury through a cone of filter paper with pinholes at its apex.

2; Boom.

Place the mercury with finely powdered loaf sugar and water in a strong bottle, cork, and shake vigorously. Then by means of a bellows blow air into the bottle, again corking and shaking the bottle, repeating this process several times. Finally run the mercury into a cone of stiff paper with a pinhole at the apex. The mercury filters clear from the metallic oxides produced by the action of air and sugar upon the debasing metals in the impure mercury.

The distillation of commercial mercury from an ordinary glass retort provided with a Liebig condenser produces chemically pure mercury.

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THE WORKING OF STEEL.

(Dr. C. C. Allen.)

The giving of a certain desired degree of hardness to a piece of steel has come generally to be called tempering, but, scientifically speaking, the tempering of a piece of steel does not refer to any particular degree of hardness it may have at any particular time, but refers to the percentage of carbon contained therein. Thus two specimens of steel, each containing a different percentage of carbon, might both be brought by proper manipulation to an equal hardness; but the term "temper" is so universally used in referring to the process of obtaining some desired degree of hardness that it has come to be correct. The ordinary method of tempering steel is to heat the articles to be tempered to a bright red heat, but not above the point of recoalescence, and plunge into water, oil, mercury, or some tempering solution, thereby depriving the heated metal of its heat more or less suddenly; and the quicker the heat is extracted from the metal, the harder it will be. After this is done, most articles are found to be harder than is desired and too brittle to be useful, but a part of the hardness is removed from the steel by resorting to the process known as drawing the temper. This is accomplished by reheating to a less degree and quenching when the color of the piece indicates to the experienced eye that the desired degree of hardness has been reached. These colors run from almost a dead white to what is generally known as a steel blue—thus a range of degrees of hardness from the natural annealed condition of the metal to the utmost hardness which it is capable of receiving. A list of the colors as generally given is as follows: Pale yellow, straw yellow, brownish yellow, purplish brown, purple, light blue, dark

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blue, blackish blue. Temperatures range from 430° to 600° Fahrenheit.

Where great accuracy in temper is desired for a number of articles, such as burs, excavators, etc., they are heated in large quantities, and great precaution is taken to heat only to such a degree as will give the best temper for the purpose.

No two lots of steel are exactly alike in the percentage of carbon contained, and therefore it may be determined beforehand what particular degree of heat is best suited to the material to be worked. The hardening of steel articles is always accompanied by a certain amount of change of form, and this change of form, while slight and of no moment in such cases as burs and excavators, is very serious in many other articles. Various schemes are employed to obviate this working in delicate pieces of work. Thus sheets of metal are liable to curl up to such a degree as to be useless, and are sometimes hardened between plates of cold steel, which keeps them straight. Many articles are straightened with wooden mallets after having been hardened — this is the case with such things as small files, ribbon saws, etc.; but an article once tempered does not admit of much further manipulation.

Again, many articles are ground into shape after having been hardened. This is always the case when hard steel bearings are made for fine machinery.

The art of tempering is one which requires much experience in order to obtain the best results, but it is an interesting thing and everyone should know something about it. In addition to tempering tool steel or steels which contain a sufficient amount of carbon to make it practicable to harden them in the usual way, we have a method known as case-

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hardening. Case-hardening may be employed in low-grade steels or in wrought iron or cast iron, and frequently is so treated where it is practicable to have the surface only of an article hardened. The process consists in converting the surface of the metal into steel, which surface is, of course, hardened as other steel is. The layer of steel thus produced is usually very thin. This may be accomplished in a number of ways. One way which is used a great deal is the heating together of yellow prussiate of potash and some substance which contains a great deal of carbon, such as leather shavings. This, combined with the articles to be hardened, is heated in a closed vessel to a red heat and held at this heat for some length of time, when the articles are taken out and plunged into cold water. If this process is properly carried out the metal will be found to have a surface too hard to be filed. Another and a cleaner way, and one better adapted to our wants, is to heat the article or articles to be case-hardened with cyanide of potash in an iron vessel to a good bright red, then remove the articles with pliers and, while still red hot, plunge them into water. The result noted before will be obtained. In each case a part of the carbon of the mixture combines with the iron to make steel. Potassium cyanide melts and will bear a red heat without change; but it should always be borne in mind that this is a very dangerous poison.

In working steel and fashioning it into its desired form it is nearly always desirable that it shall be soft, and many times it is also desirable that the finished article should be soft. The process of softening steel or any other metal is called annealing. To anneal steel it is necessary to bring it to a red heat and then cool it very slowly—the opposite, in fact, to the process of hardening. Large articles of steel

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may be fairly well softened by heating as mentioned and allowing to cool in the atmosphere; they should, however, be buried in some material which retards the radiation of heat. One of the best ways is to pack in sawdust; lime is sometimes used, also powdered charcoal. Small articles, such as broaches, needles, etc., to be annealed, must be protected from the atmosphere after heating, or they will be found to be brittle. This is because the atmosphere itself robs them of their heat so quickly that they are hardened. The slow cooling of articles to be annealed is supposed to be necessary to give the molecules time for rearrangement. But, unfortunately for this theory, there are metals which are best annealed by sudden cooling.

Steel, besides being rendered softer by annealing, is made more malleable and ductible. One great change in it is its loss of tensile strength. A piece of steel which is properly tempered and will bear a strain of 225,000 pounds per square inch is not safe under a greater strain than 85,000 pounds if it is well annealed. A familiarity with steel and iron is well worth the while of any dentist.

TEMPERING STEEL.

Steel of a grade suitable for tools, hardened by heating to a hardening heat and cooled in cold water, and then reheated to about 425° F., is of just about the right hardness for engraving tools, small lathe tools, etc. Reheated to 500° F., it is suitable for taps, dies, drills, etc.; 550° F. makes it just about right for cold-chisels, saws, etc.; 575° F. leaves but little hardness in the steel, but enough to make it suitable for springs. At about 650° F. the effect of hardening is all gone and the steel has become soft again. In practice the temperature is determined by the change in

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color of a polished surface of the steel; at 425° it is a very pale yellow, and as the temperature is increased it becomes straw color, chocolate, tinged with crimson, light purple, dark purple, and finally blue. Dental cavity-forming tools should be quite hard at the cutting surfaces and approaching a spring temper just beyond. All tools used in the root canals should be very little harder than a spring temper—just sufficiently hard to cut soft bone, yet not at all brittle.

COLOR REACTION IN TEMPERING OF STEEL.

430°—450° F. pale straw = enamel chisels.
470° F. full yellow = excavators.
490° F. brown = pluggers; scissors.
510° F. brown with purple = saws; axes.
530° F. purple = knives.
550° F. light blue = watch springs.
560° F. full blue = augers.
600° F. dark blue = hand saws.

TO TEMPER BROACHES, BURS, ETC.

Cover the bottom of a box, made of sheet iron, with powdered animal charcoal to the thickness of about one-sixteenth of an inch. Animal charcoal is readily prepared by burning pieces of leather in a covered iron box. Place on the charcoal a layer of instruments covered with charcoal, and repeat this process until the box is filled. Heat the box to a dark cherry red and keep at this temperature for an hour; remove from the fire and at once drop the contents of the box into cold water. Dry the instruments, immerse in coal oil, and place on an iron plate. Heat the plate until the oil starts to burn, remove from the flame,

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and allow to cool. The instruments will be found to be of a perfectly even temper.

TEMPERING FLUIDS FOR STEEL.

1.

Tartaric acid	1 part
Cod-liver oil	5 parts

2.

Tartaric acid	47 parts
Resin	41 parts
Mutton tallow	78 parts
Charcoal	63 parts
Potassium ferro-cyanide	39 parts
Ammonium carbonate	31 parts
Cod-liver oil	234 parts

3.

Sodium chloride	25 parts
Zinc sulphate	1 part
Ammonium chloride	½ part
Borax	½ part
Potassium nitrate	½ part
Water	250 parts

4.

Hydrochloric acid, concentrated	5 parts
Ammonium chloride	10 parts
Sodium chloride	50 parts
Glycerin	800 parts
Water	1,000 parts

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TEMPERING OF COPPER.

Copper may be rendered hard enough to take a cutting edge by treatment with potassium ferro-cyanide. The copper is melted in a graphite crucible and about 2 percent of the potassium salt is then added. After standing until the moisture has been driven off, the powder is stirred into the melt, which is allowed to stand a few minutes and again stirred. In five or ten minutes it is ready for pouring. The color of the copper is not affected by the flux. The reason for the change is supposed to be the introduction of iron and possible carbon.

TO APPROXIMATELY DETERMINE THE CHARACTER OF A METAL PLATE.

If a drop of concentrated nitric acid is placed upon a metal surface which has been freshly scratched, the resulting color helps to approximately guess the nature of the metal. Pure silver turns gray; brass, light olive green; German silver, grayish green; nickel, black. Gold above 18 carat will not show any discoloration; 16 carat gold shows a brownish hue, which deepens with the reduction of the carat.

UNITED STATES MINT TESTS FOR GOLD AND SILVER.

The following is a test for determining whether a coin is good or bad. Use the liquids as near to the edge of the suspected coin as possible, as that is the part worn. A drop of the respective liquid will have no effect on a genuine coin, while it can be plainly seen on the counterfeit. Coins should be scraped slightly before using.

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Test for Gold.

Strong nitric acid	39 parts
Hydrochloric acid	1 part
Water	20 parts

Test for Silver.

Nitrate of silver	24 parts
Nitric acid	30 parts
Water	480 parts

The above tests should be taken in conjunction with diameter, thickness and weight.

THE TOUCHSTONE, AND ITS USE.

(By Dr. Henry H. Boom.)

A method for quickly ascertaining the degree of purity of both silver and gold was so necessary to artificers that at as early a date as 450 B. C. we find the people of Lydia, in Asia Minor, employing the Lydian stone, or touchstone, for this purpose.

THE STONE.

The stone used by the Lydian goldsmiths was, probably, a hard bituminous quartz, although in more recent times black basalt, jasper, slates, and even black marble have been used.

At the present time, jewelers and metal workers use a stone of black basalt, similar in composition to the basaltic columns forming the celebrated Giant's Causeway, in County Antrim, Ireland. The modern touchstone must be densely black in color and of a quadrangular prismatic shape, measuring one inch in thickness and from two to three inches in length.

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It should show an entire absence of color, for any lightening of its dense black surface would interfere with a correct appreciation of the color left by metal that has been rubbed upon it. It must not be too hard, or in its use it will acquire too high a luster. It must not be so soft as to be grooved or furrowed by use; nor should it be of such composition as to be affected by the nitric acid with which the streak of metal left upon its surface is to be treated.

THE TOUCH NEEDLES.

These are needles like masses of pure and of alloyed silver or gold, the exact composition of which are known.

The silver needles are prepared from pure silver, alloyed with pure copper in varying proportions. The first mass of silver selected is that which we would now call chemically pure. Of such metal the manufacturer weighs out one mark, or eight ounces (sixteen half ounces), and, fusing the mass under borax, flows the metal into molds that give to the finished needle a size of one-twelfth inch in breadth, one-forty-eighth inch in thickness, and one and one-half inches in length. These needles are stamped 1, to indicate their degree of absolute purity.

The second needle of the series is then made by weighing exactly fifteen half ounces of pure silver and one-half ounce of pure copper, and this mixture, wrapped in paper, is introduced into a clean new crucible already heated and containing melted borax. The contents of this crucible, maintained at a temperature sufficiently high to melt the metal, are stirred vigorously with a wooden stick that has been charred at the end; the metal alloying is then poured into a mold, and, when cold, is weighed with care; when, should it be found to be less in weight than a mark, or

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sixteen half ounces, it will have lost, through vaporization, so much of its silver as to unfit it for use in making the touch needles.

When a perfect alloy is obtained it is remelted under borax, at a much lower temperature than was required in its making, and is molded in the appropriate needle shapes. These finished needles are stamped 2. The needles—in increasing proportions of copper—are made in this same careful manner, and the series, when perfect, then show in composition:

No. 1—Made from mass of pure silver weighing 16 half oz.
No. 2—Pure silver, 15 half oz.; pure copper, 1 half oz.
No. 3—Pure silver, 14 half oz.; pure copper, 2 half oz.
No. 4—Pure silver, 13 half oz.; pure copper, 3 half oz.
No. 5—Pure silver, 12 half oz.; pure copper, 4 half oz.
No. 6—Pure silver, 11 half oz.; pure copper, 5 half oz.
No. 7—Pure silver, 10 half oz.; pure copper, 6 half oz.
No. 8—Pure silver, 9 half oz.; pure copper, 7 half oz.

GOLD TOUCH NEEDLES.

The needles are made of the same breadth and thickness as the silver needles, but, to less the expense, they generally are made but one-quarter or one-half inch in length, and these, called points, are soldered to copper bars of corresponding sectional area.

A number of series of gold touch needles, or points, are used; thus, gold alloyed solely with silver forms a series known as the "white alloy" series; another series of gold points, called "red gold" points, are composed solely of gold and copper. The most careful gold touch needles for the dentist's employment are alloys of gold, silver and copper, called the "mixed alloy." The touch needles of

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mixed alloy are made from gold debased with varying proportions of silver and half as much copper.

In making the alloys for the needles the manufacturers must employ the greatest of care, that there may be no loss of metal (gold and silver) through volatilization or oxidation (copper). When the alloy is obtained it must not vary in weight from the sum of the weights of its constituent metals. The carat weighs 12 grains; the composition and markings of the touch needles are shown in the following:

No. 1—Made from a mass of pure gold, weight 24 carats.
No. 2—Contains, pure gold, 23 carats, 6 grains; pure silver, 4 grains; copper, 2 grains.
No. 3—Contains, pure gold, 23 carats; pure silver, 8 grains; copper, 4 grains.
No. 4—Contains, pure gold, 22 carats, 6 grains; pure silver, 1 carat; copper, 6 grains.
No. 5—Contains, pure gold, 22 carats; pure silver, 1 carat, 4 grains; copper, 8 grains.
No. 6—Contains, pure gold, 21 carats, 6 grains; pure silver, 1 carat, 8 grains; copper, 10 grains.
No. 7—Contains, pure gold, 21 carats; pure silver, 2 carats; copper, 1 carat.
No. 8—Contains, pure gold, 20 carats, 6 grains; pure silver, 2 carats, 4 grains; copper, 1 carat, 2 grains; etc.

For convenience in their use the touch needles are usually strung upon rings.

THE USE OF THE TOUCHSTONE.

Each metal, when pure, has a specific color. Alloying a metal changes its color. Metals are so opaque that their

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colors are only determined with accuracy when a thin film of the metal is spread upon a densely black surface. In using the touchstone the operator first cleans a portion of its surface, using for this purpose fine coal dust, tripoli or putty powder.

He then rubs the gold (of unknown fineness) upon the stone, stroking the stone several times with the gold. The metal streak of gold left upon the stone should be one-tenth inch in width and at least one-fourth inch in length. Then, selecting a touch needle that appears to be of about the same fineness (color) as the specimen he is testing, he makes a metal streak with the touch needle upon the stone, close to the first streak, and then wets each streak with water and compares their colors when moistened. Should the colors of the two metal streaks fail to correspond, he tries with another touch needle, of lower or greater fineness, to match the color given to the surface of the stone by the metal of unknown composition.

In all this examining of color he must not forget to moisten the metal streaks. When the operator, employing a needle, secures a metal streak on the stone that corresponds to the streak given by the metal tested, he then wets each streak with nitric acid, and the acid, dissolving from the streaks from the silver and copper used to debase the gold, causes the latter to present in the streak a broken or interrupted line, indicating by the loss of continuity the relative amount of debasing metal alloying the specimen of gold. By this method of testing it is possible for the dentist to ascertain, like the jeweler, the carat or fineness of gold, in a very few minutes, and so be able to select the solder or plate best suited for each piece of repair work he may undertake.

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ROUGH METHOD OF ESTIMATING HIGH TEMPERATURES.

Zinc melts at	800° F.
Slight glow in dark at	975° F.
Dark red heat at	1,280° F.
Cherry-red heat at	1,650° F.
Bright cherry-red heat at	1,800° F.
Silver melts at	1,900° F.
Gold melts at	2,012° F.
Orange heat at	2,100° F.
Copper melts at	2,190° F.
White heat at	2,350° F.
Steel melts at	2,465° F.
Dazzling white heat at	2,750° F.
Platinum melts at	3,240° F.
Wrought iron melts at	2,900° F.

TEMPERATURES PRODUCED BY VARIOUS FLAMES

The highest temperatures afforded by flames are, according to Fery, as follows:

Bunsen burner, with sufficient access of air	3,400° F.
Bunsen burner, with insufficient access of air	3,105° F.
Acetylene flame	4,645° F.
Denayrouz's burner (alcohol and air)	3,383° F.
Denayrouz's burner (alcohol and petroleum ether, equal parts)	3,700° F.
Alcohol flame	3,100° F.
Hydrogen flame in open air	3,450° F.
Oxy-hydrogen mixture	4,300° F.
Oxygen and illuminating gas blast flame	4,000° F.
Electric arc (estimated)	6,800° F.
Temperature of the sun (estimated)	14,075° F.

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THE HEAT CONDUCTING POWER OF METALS.

Silver	100	Tin	14
Copper	74	Bismuth	12
Gold	53	Iron	12
Zinc	36	Lead	9
Brass	24	Platinum	8

CONTRACTION OF CASTINGS IN COOLING.

Cast iron	.125 percent
Copper	.193 percent
Brass	.210 percent
Lead	.319 percent
Tin	.278 percent

TO TEST NEW CRUCIBLES.

Heat to redness and put a cold iron rod into crucibles, touching the bottom. Cracks will expand and may easily be seen.

POLISHING POWDERS.

For Brass.

Chalk	10 parts
White bole	4 parts
Magnesium carbonate	1 part
Iron oxide	1 part

For Gold or Silver.

Chalk	54 parts
Magnesium carbonate	5 parts
Alumina	14 parts
Silica	8 parts
Iron oxide	5 parts

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TO RESTORE TARNISHED GOLD PLATES TO THEIR ORIGINAL COLOR.

Iron oxide, red (Crocus martis)	3 parts
Calcined borax	2 parts
Ammonium chloride	1 part

Powder and mix slowly with water to form a paste.

Paint over the plate, heat on a copper pan until no hissing sound is heard, place aside to cool, and boil in diluted hydrochloric acid and dry in sawdust.

GOLD POLISHING FLUID.

Chlorinated lime	1 part
Sodium bicarbonate	20 parts
Sodium chloride	1 part

Water, enough to make a paste.

Apply with a soft brush, and, when dry, polish.

SILVER POLISHING FLUID.

Sodium hyposulphite	16 parts
Ammonium chloride	8 parts
Water of ammonium	4 parts
Potassium cyanide	4 parts
Water	120 parts

CLEANING OF SILVER BY ELECTROLYSIS.

A few strips of zinc are shaped so as to form a grid. The ribs of the grid are heavily coated with tin and placed on the bottom of a tin pan of convenient size. The pan is filled with two quarts of water, in which one ounce of sodium chloride and one ounce of sodium bicarbonate are dissolved. The tarnished silverware is placed on the grid, and immediately the evolution of hydrogen takes place,

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which will remove the tarnish in a few minutes. The silverware must be completed covered by the solution. The silver itself will not be affected by this process, only its oxides are removed.

LIQUID METAL POLISHES.

1.

Kieselguhr	56 parts
Kerosene	30 parts
Alcohol	15 parts
Oil of turpentine	5 parts
Ammonia water	5 parts

2.

Tripoli	10 parts
Kieselguhr	10 parts
Olein	15 parts
Carbon tetrachloride	90 parts

3.

Prepared chalk	100 parts
Olein	65 parts
Ammonia water	40 parts
Alcohol	50 parts
Carbon tetrachloride	50 parts

4.

Olein	10 parts
Stearin	5 parts
Kieselguhr	20 parts
Oil of turpentine	20 parts
Kerosene	25 parts
Alcohol	5 parts
Ammonia water	10 parts

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5.

Oleic acid	10 parts
Stearic acid	5 parts
Infusorial earth	20 parts
Oil of turpentine	20 parts
Kerosene oil	25 parts
Wood alcohol	5 parts
Water of ammonia	6 parts
Water	6 parts

6.

Putty powder	6 parts
Kieselguhr	20 parts
Bath brick	2 parts
Emery	1 part
Rottenstone	1½ parts

Mix well together and gradually add the following:

Wood alcohol	30 parts
Oil of turpentine	15 parts
Petrolatum	80 parts
Ammonia water	15 parts
Oil of citronella	½ part

Note.—The difficulty experienced with most liquid metal polishes is to keep the polishing ingredients in suspension. If the vehicle is made too heavy, as with a crude ammonium oleate compound, a wide mouth bottle is necessary, while the problem with a thinner preparation is to prevent the kieselguhr from caking at the bottom of the bottle. A mixture of ordinary kerosene oil and crude oleic acid makes a good vehicle for a liquid metal polish or

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"Putz." One part of kerosene to five parts of crude oleic acid is about the right proportion to use, and to a pint of such a mixture there may be added two ounces of kieselguhr and ten or twelve drops of oil of myrbane.

POLISHING PASTES.

1.

Pumice stone (in fine powder)	20 parts
Oleic acid	20 parts
Tallow	2 parts
Paraffin	4 parts

Melt the oleic acid, tallow, and paraffin together and gradually stir in the pumice stone, stirring continuously until cold.

2.

Precipitated chalk	2 parts
Water of ammonia	2 parts
Wood alcohol	13 parts
Water, enough to make	100 parts

Shake well before using.

TO CLEAN NICKELED INSTRUMENTS.

1.

Place the instruments in a mixture of

Sulphuric acid	1 part
Alcohol	50 parts

Let remain for ten minutes, remove, wash in hot water, and dry in sawdust.

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2.

Prepared chalk	2 parts
Water of ammonia	2 parts
Alcohol	2 parts
Water	4 parts

Rub the instruments with a cloth saturated with the mixture, then wipe them with a dry cloth.

3

Ammonium carbonate	30 parts
Water	120 parts
Dissolve and add	
Precipitated chalk	480 parts

Spread this paste over the surface of the object to be polished and rub with a soft flannel cloth first, then with a piece of chamois skin. If the metal surface has any pits or fissures, a brush may be employed.

4.

Cover the rust spots with engine oil and in a few days rub and polish with a paste made of chalk and water of ammonia. If the spots are very resistant they may be treated with diluted hydrochloric acid, followed immediately by the above paste.

5.

One of the best methods known for keeping bright the nickel work about the office is to wet a rag with a solution of hyposulphite of soda and wipe the article with it, drying with a soft towel and then rubbing it with a piece of chamois.

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TO REMOVE RUST FROM POLISHED STEEL.

1.

To remove rust from polished steel, potassium cyanide is excellent. Soak, if possible, the instrument to be cleaned, in a solution of potassium cyanide in the proportion of one part of cyanide to four parts of water. Allow this to act until all loose rust is removed, and then polish with cyanide soap. The latter is made of potassium cyanide, precipitated chalk, and white castile soap. Make a saturated solution of the cyanide and add chalk sufficient to make a creamy paste. Add the soap, cut in fine shavings, and thoroughly incorporate in a mortar. When the mixture is stiff, cease to add the soap. It should be remembered that potassium cyanide is a violent poison!

2.

Rusted surgical instruments, etc., are placed over night in a saturated solution of stannous chloride, which causes the spots to disappear by reduction. The articles are then rinsed in water, laid in a hot solution of soda soap, and dried. It is well to rub them with absolute alcohol and prepared chalk. Another convenient method for removing rust is to lay the instruments in kerosene. Paraffin oil is the best preservative against rust, and the most convenient way of applying it without getting an unnecessarily thick coating is as follows: One part of oil is dissolved in two hundred parts of benzine, and the objects, after being thoroughly dried and warmed, are plunged into the solution. Instruments with joints, as scissors or needle holders, are washed in the fluid, in order to cause it to penetrate into

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all crevices, and the benzine is then allowed to evaporate in a dry-room.

TO CLEAN ENGRAVED COPPER.

Wash thoroughly with soap and water, and dry thoroughly. Then rub the surface with a fresh lemon cut in half, rinse with tepid water, dry, and polish with chamois leather. Powders and polishing pastes should never be used on worked copper, for the particles get lodged in the chasings and are very difficult to remove.

LINING OF RUBBER DENTURES WITH ALUMINUM; LA SALLE.

For the solvent use chloroform one part, carbon disulphide one part, and naphtha one part; for powder, the aluminum used by plumbers in bronzing metal work. Pack the case as usual, using the flask press and the wet cloth to test the pack. An excess of rubber is fatal to best results. The flask should be made to come together under gentle pressure. The palatal surface of the denture should be made of as large pieces as possible. This gives a smooth surface and prevents penetration of the mass by the lining—an event certain to mar the appearance of the palatal surface of the denture. After packing, a swab of cotton wound on a wood toothpick is dipped into the solvent and applied to the palatal surface of the pack, and a small quantity of the powder dusted on to this moistened surface and rubbed in with the swab, again saturated with the solvent. This procedure is continued until the surface refuses to hold more. A new swab is then made and used dry, and with it dry aluminum is applied to the model. The flask is then closed and bolted, and the case vulcanized. With the vulcanization completed, the flask is allowed to

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become "stone cold" before opening. Without this precaution the lining would adhere in part to the model.

TO MAKE GOLD COHERE UNDER ALL CONDITIONS; DODEL.

When it is advisable to repair an old gold filling without removing the gold already in position, it may be accomplished by following the directions here outlined:

(1) Apply the rubber dam. (2) Clean the tooth carefully with lukewarm water. (3) Wash it with sulphuric ether, to dissolve any fatty or oily substances. (4) Go over the filling with alcohol. (5) Dry with warm air. (6) Take a gold cylinder and unroll it, until you have but one thickness, or take gold foil No. 4; carefully anneal this, as it readily melts. (7) With a very fine pointed plugger go over the entire surface of the gold put on, first with hand pressure, then mallet it well. (8) After that, go over it with a convex plugger. (9) The direction of the force should be at right angles to the surface worked upon. (10) If you have followed these directions in applying two layers, you can go ahead in the usual manner and use either pellets or leaf gold. Having tested it in various positions, I find it entirely satisfactory except where the filling is subject to great stress, when it is ill-advised.

TO IMITATE GOLD FILLING IN PORCELAIN TEETH.

Pure powdered gold	100 parts
Mercury oxide, yellow	150 parts
Bismuth tri-nitrate	9½ parts

Mix with thick oil of turpentine, paint upon tooth, and carefully heat in oven or flame. Polish with burnisher.

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TO REPAIR A GOLD PLATE WITHOUT REMOVING THE RUBBER-MOUNTED TEETH.

Attach to the plate the negative wire of the lighting circuit, and to the positive wire a small carbon, cutting in, in series, a bowl of salt water as a rheostat. The hole in the plate is cleansed and prepared in the usual way, then covered with a piece of gold foil and 18 carat solder upon it, with borax as a flux. The carbon point is brought in contact with the solder and then gradually removed, forming the arc, which is held sufficiently long to melt the solder. Immerse the plate immediately in water.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER V.

PLATING, COLORING, LACQUERING, AND ETCHING OF METALS.

ELECTROPLATING OF METALS.

When an electrified body is discharged through a conductor, an electric current is produced, known as the circuit. The circuit represents the entire path traveled by the current, including both that within the cell and that without. The current passes from the negative pole, i. e., the positive plate of the cell, to the positive pole, i. e., the negative plate of the cell. When the poles of a cell are connected by wire immersed in a salt solution in which a piece of metal of the same nature as the salt present in the solution and a piece of metal of a different character are suspended, the piece of metal attached to the negative pole will be covered with a coat of metal as presented in the solution. The process is referred to as electroplating. The negative pole, carrying the article to be plated, is spoken of as the cathode, and the positive pole, carrying the plating metal, is spoken of as the anode.

PRACTICAL HINTS TO BE OBSERVED IN ELECTROPLATING.

Ordinary dry cells (Columbia type), or wet cells (Leclanché type), furnish the best current for small plating outfits. A Leclanché cell furnishes, in average, one and

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one-half volts; the dry cells, from one and three-tenths to one and seven-tenths volts. Ordinarily, two cells are necessary for dental work. The current must never be so strong as to produce small bubbles upon the cathode; too weak a current produces a milk-colored deposit.

Use the purest chemicals obtainable.

Heating the solution to about 100° F. facilitates ready plating.

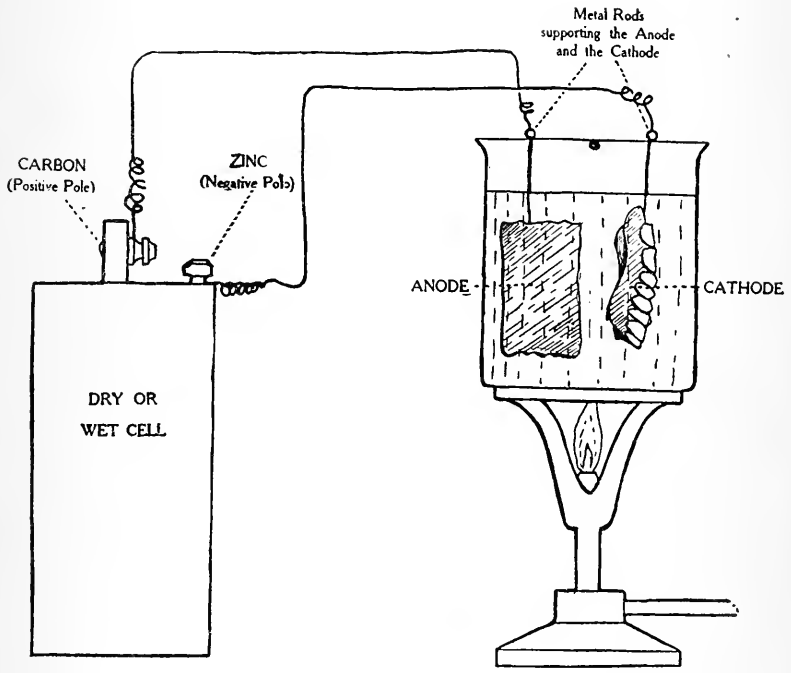

Fig. 1.

Scheme for arranging a simple electroplating outfit.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

In making the solution, all the salts, with the exception of the metal salts proper, should be dissolved first, the metal salts are added last.

Gold or platinum wire soldered to the anode and attached to the article to be plated, the cathode, should be used only. Base metal wire produces poorer results.

Between the anode and the cathode, as suspended in the solution, there should be from 1 to 2 inches of space; the articles must never touch each other during the plating process.

Articles made of German silver, bronze, or other metal alloys must be copper-plated before the final gold, silver or nickle plating is made.

The vessels used in plating should be of glass, stoneware or porcelain.

Before immersing the articles into the plating solution it must be boiled in a solution of caustic potash (1 ounce to a pint of water) to remove fat, oil, finger greases, etc. Remove with wire hook and wash in water. Do not again touch with fingers.

If articles are oxidized, they must be boiled for a short time only in a weak solution (1:10) of sulphuric or hydrochloric acid.

Places which should not be covered by the plating solution must be carefully varnished with asphalt varnish. The varnish must be perfectly dry before the goods are immersed in the plating solution.

The time necessary to accomplish a good plating varies with the size of the article, from ½ to 5 hours may be required; the color of the plated article is usually the best indicator.

After the plating is accomplished, the article is re-

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moved from the solution and boiled in water for a few minutes and the still hot article is thrown in jeweler's saw dust and dried. Polish in the usual manner.

AN INEXPENSIVE GOLD PLATING OUTFIT FOR SMALL WORK.

Dissolve one-fourth ounce of potassium cyanide in two and one-half ounces of pure water in a warm bath. Also fifteen grains of chloride of gold in two and one-half ounces of cold water. Mix the two liquids and pour into a glass or porcelain dish. Procure three pieces of insulated copper wire, each sixteen inches in length and about 22 gauge. Remove two inches of the insulation on each end of the wires. Use two of these for connections with a dry battery, such as are used for hall bells or alarms.

To the anode attach a piece of pure gold, and to the cathode the appliance to be plated. Immerse in the plating solution after previously cleansing in a heated solution of caustic potash, followed by a wash of clear water. For this cleansing use the third wire and do not handle the appliance with the fingers. Stir the plating solution occasionally. The outfit complete can be procured for less than one dollar.

PLATING SOLUTIONS.

Silver Plating Solution.

I.

Silver cyanide	2 parts
Potassium cyanide	5 parts
Distilled water	35 parts

Use pure silver plate as the anode.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Silver chloride	3 parts
Sodium phosphate	40 parts
Potassium cyanide	25 parts
Potassium hydrate	15 parts
Distilled water	1000 parts

3.

Silver nitrate	68 parts
Distilled water	1000 parts

Dissolve, and mix with

Potassium cyanide	104 parts
Distilled water	1000 parts

This solution produces a heavy deposit.

GOLD PLATING SOLUTION.

1.

Sodium phosphate	25 parts
Sodium sulphate	5 parts
Gold chloride	3 parts
Potassium cyanide	10 parts
Distilled water	560 parts

The anode must be attached to a piece of pure gold plate of nearly the same size as the article to be plated.

2.

For Plating Iron and Steel Goods.

Sodium phosphate, crystals	50 parts
Sodium sulphate	12 parts
Potassium cyanide	½ part
Gold chloride, crystals	1 part
Distilled water	1000 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

COPPER PLATING SOLUTIONS.

1.

Copper acetate	5 parts
Sodium carbonate, crystals	5 parts
Sodium sulphite	5 parts
Potassium cyanide	5 parts
Distilled water	280 parts

Use pure copper plate as the anode.

2.

Copper acetate	20 parts
Sodium carbonate	25 parts
Acid sodium phosphate	20 parts
Potassium cyanide	23 parts
Distilled water	1000 parts

NICKEL PLATING SOLUTION.

1.

Nickel sulphate	10 parts
Sodium citrate	9 parts
Distilled water	280 parts

Use pure nickel in sheet form as the anode.

2.

Nickel and Ammonium sulphate	70 parts
Boric acid	25 parts
Distilled water	1000 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PLATINUM PLATING SOLUTION.

Solution 1.

Platinum chloride	4 parts
Ammonium phosphate	20 parts
Sodium phosphate	100 parts
Distilled water	1000 parts

Solution 2.

Platinum chloride	4 parts
Distilled water	1000 parts

Both solutions are mixed with constant stirring. A yellow precipitate of platinic ammonium chloride is formed. To dissolve this precipitate add a solution of

Sodium phosphate	100 parts
Distilled water	700 parts

and boil the whole mixture until the precipitate is dissolved. After complete solution, the solution is reduced by evaporation to about 1500 parts.

BRASS PLATING SOLUTION.

Iron, copper or zinc articles may be readily brass plated with the following solution:

Copper sulphate	$1\ ^{6}/_{10}$ parts
Zinc sulphate	10 parts
Potassium cyanide	16 parts
Distilled water	1000 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

GOLD PLATING WITH ALUMINUM CONTACT.

1.

Gold chloride ..... 1½ parts
Potassium cyanide ..... 16 parts
Distilled water .....1000 parts

Dissolve the gold chloride in 500 parts of warm distilled water and the potassium cyanide is 500 parts of warm distilled water. Mix the two solutions. The article to be plated is wound with an aluminum wire and placed in a hot 5 percent solution of potassium or sodium hydrate; it is now rinsed in water and placed in the heated gold solution. Depending on the size of the article, it may remain in the gold bath from 15 seconds to 2 minutes or until a sufficiently heavy deposit is obtained. It is then removed, washed in water and polished in the ordinary way.

2.

Gold chloride..... 1 part
(or silver chloride for silver plating)
Potassium cyanide..... 25 parts
Sodium phosphate..... 16 parts
Potassium hydrate..... 10 parts
Distilled water.....500 parts
Boil the solution.

The perfectly clean and highly polished article is held by an aluminum wire and moved about in the boiling liquid for ½ to 2 minutes; it is then removed, washed in alcohol, and dried in sawdust.

GOLD SOLUTION FOR PLATING WITHOUT A BATTERY.

Sodium pyro-phosphate, crystals..... 80 parts
Hydrocyanic acid, 12 percent..... 8 parts
Gold chloride, crystals..... 2 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

GOLD PLATING OF ALUMINUM BASE PLATES.

After the aluminum base plate is swaged, it is placed in a 10 percent potassium hydrate solution for a few minutes, removed, washed in water and placed in diluted hydrochloric acid and left there until small gas bubbles are visible upon its surface. It is now immediately transferred to a 25 percent solution of mercuric chloride, left there a few moments and transferred to the acid bath in which it remains until the gas bubbles again start to form. It is now placed in a 10 percent gold chloric solution. Immediately it is covered with a tense film of gold, which may be readily polished.

FIRE GILDING.

Gold-amalgam for fire gilding is prepared by alloying

Pure gold	1 part
Mercury	8 parts

A Dixon black lead or English clay crucible is coated with prepared chalk, the gold is cut into small pieces and heated in the crucible to a dull redness and the mercury added and stirred. Pour in water.

"Quickening" solution is prepared by dissolving (in the open air):

Mercury	10 parts
in	
Nitric acid	11 parts
and adding	
Distilled water	275 parts

Clean the article thoroughly and apply the "quickening" solution; with a copper spatula rub the gold amalgam over

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the "quickened" surface and remove the surplus of the amalgam with a soft brush. The article is now slightly heated to evaporate the mercury, leaving a pure layer of gold. With prepared chalk and borax solution the article is finally polished.

Caution: Mercury fumes are very poisonous; they must not be inhaled.

SILVER PLATING PASTE.

1.

Silver nitrate	1 part
Sodium chloride	1 part
Potassium cyanide	2 parts
Chalk, a sufficient quantity.	

Dissolve the silver nitrate in 16 parts of water and add the sodium chloride, dissolved in an equal amount of water. Mix thoroughly and collect the precipitate on a piece of damp cotton cloth. Transfer the moist precipitate to a mortar containing the potassium cyanide in powder and dissolve by adding more water if necessary. Now add sufficient chalk to make a spreadable paste.

To resilver the tarnished article spread the paste upon the spot which must be free from grease, dirt, etc. and let remain two hours, then brush off. Repeat if necessary.

2.

Silver nitrate	36 parts
Potassium cyanide	60 parts
Precipitated chalk	100 parts
Potassium bitartrate	5 parts
Water	enough

Dissolve the silver nitrate and potassium cyanide sepa-

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

rately in a minimum of water; mix them and add the chalk and potassium bitartrate and sufficient water to make a paste.

SILVERING SOLUTION.

A solution that is considerably used for covering the worn parts of plated goods has the following composition:

Silver nitrate	35 parts
Sodium chloride	60 parts
Alum	30 parts
Potassium bitartrate	180 parts
Water	1000 parts

The solution is applied by friction with a sponge or rag to the previously well cleaned article.

SILVER PLATING OF ORGANIC SUBSTANCES.

Ivory, horns, bone, vulcanized rubber, leather and similar materials may be coated with a layer of silver as follows: The material is heated to about 150° F. and painted over with a hot solution of 2 parts of gallic acid in 100 parts of water. After drying, a one percent solution of silver nitrate in distilled water is painted over the parts and this process is alternately repeated until the desired silver color is obtained.

NICKEL PLATING WITHOUT A BATTERY.

It is not so easy to deposit nickel on the surface of brass as silver, but the following processes represent perhaps, the most practicable methods in use. The first method is known as the Mitressey process, by which any desired thickness of plating may be deposited, yielding a surface which is said to be more solid than electroplated nickel:

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

1.

First Bath.—Clean the objects and take 5 parts by weight of potassium carbonate for 25 parts by weight of water. If the pieces are quite rusted, take 2 parts by weight of hydrochloric acid for 1 part by weight of water. The bath is employed cold.

Second Bath.—Put 25 parts by weight of copper sulphate in 2500 parts by weight of water. After dissolution add a few drops of sulphuric acid, drop by drop, stirring the liquid with a wooden stick until it becomes as clear as spring water. Take the cleaned pieces and place them in what is called the copper bath, attaching to them leaves of zinc; they will assume a red tint. Then pass them into the nickeling bath, which is composed of:

Potassium bitartrate	20 parts
Ammonium chloride	10 parts
Sodium chloride	5 parts
Stannic chloride	20 parts
Nickel sulphate, single	30 parts
Nickel sulphate, double	50 parts

Remove the pieces from the bath after a few minutes exposure, and rub with fine sand on a moist rag. Brilliancy will thus be obtained. To improve the appearance apply a brass wire brush.

2.

Prepare a bath of neutral zinc chloride and a neutral solution of a nickel salt. The objects are immersed in the bath with small pieces of zinc and kept boiling for some

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time. This process has given satisfactory results. It is easy to prepare the zinc chloride by dissolving zinc in hydrochloric acid, as well as a saturated solution of ammoniacal nickel sulphate, in the proportion of two parts of the latter to one of the zinc chloride. The objects should be boiled for fifteen minutes in the bath. Nickel chloride may also be employed.

PLATINUM-PLATING OF DENTAL INSTRUMENTS.

Platinum chloride	1 part
Water	1 part
Hydrochloric acid	3½ parts
Alcohol	20 parts
Dissolve and evaporate to	15 parts

And add

Ether	75 parts

With a woolen cloth rub this liquid upon the clean instrument, heat to about 100° F. and polish.

COPPER PLATING ALUMINUM.

Copper sulphate	30 parts
Potassium and sodium tartrate	30 parts
Sodium carbonate	25 parts
Water	1000 parts

The aluminum article is thoroughly cleansed in a weak potassium hydrate solution and placed in the heated bath.

COLORING OF METALS.

Copper.

Black.—To color copper black immerse the object, previously well cleansed, in the following solution, let remain for from 30 to 45 minutes, and afterwards wash well:

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

1.

Antimony chloride..... 15 parts
Alcohol .....125 parts
Hydrochloric acid, sufficient to dissolve.

The less of the acid that is used, the better the result. This process deposits a coating of antimony.

2.

Plunge the well cleansed object in nitric acid, remove and heat to a dull red. It deposits a coating of copper oxide.

3.

Plunge the copper, previously well cleansed, into the following:

Arsenous acid..... 2 parts
Hydrochloric acid..... 4 parts
Sulphuric acid..... 1 part
Water ..... 24 parts
It causes a deposit of arsenic.

Bluish-Gray.—Suspend the object in the following at an almost boiling heat:

Sodium sulphide..... 1 part
Antimony sulphide..... 1 part
Water ..... 12 parts

Let remain until the desired tint is obtained, wash rapidly with water and dry.

Brown.—Immerse in nitric acid sufficiently long to give a bright surface, rinse in clear water and plunge into a solution of iron chloride.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Olive-Green.—Cover with a solution of iron and arsenic in hydrochloric acid. Polish with lead-minimum, warm, and cover with the following varnish:

Gamboge	1 part
Yellow ochre	1 part
Alcoholic varnish	1 part

To make iridescent:

Lead acetate	2 parts
Sodium hypophosphite	6 parts
Water	100 parts

Mix, and heat to boiling. When in active ebullition, plunge the object in it and keep until the desired tints are obtained. Dry and varnish. The copper takes on, successively, gray, violet, chestnut, red, and finally blue.

Bronze.—First tin the copper by boiling in a weak solution of acid potassium tartrate, in which granulated tin has been placed.

Wash, dry, and warm until the desired tint is obtained.

Zinc.

Black.—Clean the zinc by dipping in acid, rinse and plunge into the following:

I.

Nickel ammonium sulphide	4 parts
Sulphuric acid	1 part
Water	40 parts

Wash the article and dry carefully.

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2.

Treat with the following solution:

Hydrochloric acid	6 parts
Antimony chloride	10 parts
Alcohol	100 parts

When the desired shade is attained, dry and rub with some good drying oil. Give 2 or 3 coats.

Green-Patina.—Make the following solution:

Sodium hyposulphite	2 parts
Sulphuric acid	1 part
Water	20 parts

Filter off the precipitated sulphur and heat the filtrate. Plunge the object into the hot solution. Watch the coloration as it progresses and when the desired tint is secured, remove, let dry and varnish with copal varnish.

To Bronze.—First cover with copper by galvanism, then wash with the following solution:

Potassium oxalate	8 parts
Ammonium chloride	30 parts
Vinegar	1000 parts

Rinse and let dry.

Silver.

To Blacken.—Plunge into a solution of an alkaline sulphite (sulphurated potassa). Remove and rub with a brush dipped in powdered cream of tartar.

Baths for Oxidizing Silver.

The peculiar appearance on the surface of silver articles that has been termed "oxidized silver" can be produced in

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a variety of ways, the particular tone depending upon the treatment to which the metal is submitted.

A mixture of 6 parts of graphite and 1 part of powdered hematite (or rouge) is prepared, and moistened with oil of turpentine. The surface of the object to be oxidized is covered with this paste, which is allowed to dry, and then dusted off with a soft brush. The object is now immersed in a solution, heated to about 176° F., consisting of 5 parts potassium sulphide, 10 parts ammonium carbonate, and 1000 parts of water. If the following solution be employed a rich brown tone is produced: 20 parts copper sulphate, 10 parts saltpetre, and 20 parts ammonium chloride.

Bromine vapor blackens silver and its alloys, and by its use extraordinarily artistic effects can be produced, especially upon engraved surfaces.

The silver objects may also be covered with ammonium sulphide in a porcelain vessel and gradually warmed. As soon as a bluish-black color appears they are taken out of the bath, placed in soap water, and gently rubbed with a soft brush, while immersed.

A bath which produces the same effect as potassium sulphide, can be prepared as follows, and has the advantage of being very cheap: 1000 parts of water are poured over a mixture consisting of 370 parts of quicklime, and 640 parts flowers of sulphur. Considerable heat is evolved, and a pasty mass forms; the latter is diluted with 1000 parts of hot water, and boiled for an hour. The resulting liquid is ready for use, and is best employed after slightly warming. It produces a bluish-gray surface on silver, while, if 50 parts of gray antimony sulphide or cinnabar be

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added during the boiling, the color will be a beautiful grayish brown.

Brown Color.—To give silver a deep brown, treat it with a solution of ammonium chloride and copper sulphate, equal parts, in vinegar.

To Oxidize Silver.

1.

Light Color.—

Sulphuretted potash (liver of sulphur)	5 parts
Ammonia water	10 parts
Water	60 parts

2.

Dark Color.—

Chlorinated lime	10 parts
Sodium chloride	8 parts
Sodium carbonate	20 parts
Water	30 parts

Boil the article in this solution under a good ventilator as intensely ill-smelling gases are produced.

To Oxidize Silver With Platinum.

Platinum chloride	2.3 parts
Water	1000.0 parts

Dissolve and add

Alcohol	500.0 parts

The silverware, previously cleaned in a caustic soda solution, is immersed in the warmed platinum solution, removed and lightly heated over a Bunsen flame. Care should be taken so as not to burn the alcohol. If the black color is not deep enough, the process is to be repeated.

Rose Color.—Immerse for a few seconds in a con-

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centrated hot solution of copper chloride, rinse, dry and immerse in alcohol. Finally, dry off by holding near the fire.

IRON AND STEEL.

Bronzing.—Lay the object for a moment in a solution of iron perchloride and copper sulphate with a little added nitric acid. Remove and dry at a temperature of about 85° F. Finally suspend in a closed box containing a vessel of boiling alcohol, and leave for 20 minutes, keeping the alcohol boiling all the time. Scratch off with a scratch brush. Repeat operation several times or until the desired tint is obtained.

Blue Black.—Clean the object thoroughly, removing every trace of grease, then cover with the following:

Copper sulphate	8 parts
Nitric acid	15 parts
Alcohol	30 parts
Water	125 parts

Mix, and dissolve. Let dry on, and when quite dry rub with a woolen cloth.

Brilliant Black.—Boil the following together:

Sulphur	1 part
Oil of turpentine	10 parts

While boiling spread in a very light coating, by means of a pencil, over the surface and heat in the flame of an alcohol lamp until black.

Brown.—Make the following solution:

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Iron sulphate	20 parts
Copper sulphate	2 parts
Sweet spirit of nitre	4 parts
Water	200 parts

Place the iron in the solution, dry and polish with boiled linseed oil.

Bronzing Gun Barrels.—Make the following solution:

Solution of ferric chloride	4 parts
Mercuric chloride	3 parts
Fuming nitric acid	3 parts
Copper sulphate	3 parts
Water	80 parts

With a brush or pencil go over the barrels with this liquid. Repeat this two or three times. Finally plunge the barrels into a 1 percent solution of potassium sulphide and let remain for ten days. At the end of the time wash in hot suds, dry off and cover with linseed oil, which let dry on.

BRASS.

Silver Color.—

Cream of Tartar	46 parts
Tartar emetic	4 parts
Dissolve in boiling water	1000 parts

and add

Hydrochloric acid	50 parts
Tin, granulated	125 parts
Antimony	30 parts

Bring the solution to a boil, immerse the brass article and dry in sawdust.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Platina.—The green coating—"Patina"—found upon bronze objects, especially such as have laid buried for some time, is not only pleasing to the eye but also serves a practical purpose, in that the metal beneath is protected from further corrosion.

Brass objects can be coated as well as bronzed, by the following solution:

Copper	30 parts
Nitric acid, concentrated	60 parts
Acetic acid, 6 percent	600 parts
Ammonium chloride	11 parts
Ammonia water	20 parts

The copper is dissolved in the nitric acid, and, as soon as solution is effected, the other ingredients are added. The solution must be allowed to stand several days before using.

The objects to be coated are either dipped into the solution for a moment, or the solution is applied to the surface by means of a brush. They are then allowed to dry, and are finally covered with a thin coat of linseed oil.

Steel Blue.—To obtain a beautiful steel blue color, the cleaned brass is dipped in a heated mixture of the following solution:

I.

Antimony sulphate	12 parts
Sodium carbonate, calcined	120 parts
Water	750 parts

Dissolve and add

Sulphuretted antimony	22 parts

Filter.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Cream of tartar..... 22 parts
Sodium hyposulphite..... 45 parts
Water .....750 parts

Equal parts of solutions 1 and 2 are freshly mixed when needed.

Black.—Mix equal parts of the following solutions when needed.

1.

Silver nitrate..... 25 parts
Water .....100 parts

2.

Copper nitrate..... 25 parts
Water .....100 parts

The cleansed brass is plunged into this freshly mixed solution, removed and heated evenly until the desired degree of dead blackness is obtained.

BLACKENING OF METALS.

Solution 1.

Silver nitrate.....192 parts
Distilled water.....480 parts

Solution 2.

Copper nitrate.....192 parts
Distilled water.....480 parts

Thoroughly clean the article, especially from grease, and dip into a mixture of equal parts of above solutions. Allow it to remain in this about ten minutes, then remove, and

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

dry naturally. When dry, heat it on a sand bath until a good deep black color is obtained.

METAL LACQUERS.

1.

For Optical Goods, Microscopes, Etc.

Seed lac	32 parts
Dragon's blood	½ part
Extra red sanders	½ part
Oriental saffron	½ part
Amber	16 parts
Copal	16 parts
Coarsely powdered glass	30 parts
Absolute alcohol	320 parts

Mix. Keep in a warm place, shake occasionally until dissolved, let settle and pour off the clear liquid.

2.

For Ordinary Brass Goods.

Shellac	50 parts
Turpentine varnish	100 parts
Tumeric	125 parts
Gamboge	16 parts
Sandarac	25 parts
Alcohol, enough to make	1000 parts

3.

Shellac	75 parts
Sandarac	75 parts
Venice turpentine	10 parts
Alcohol, enough to make	1000 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Alcoholic lacquers are best colored with "Aniline dyes for spirit varnishes." They are obtained from dealers in dye stuffs.

4.

Blue Lacquer for Steel.

White shellac	5 parts
Borax	1 part
Alcohol	5 parts
Water	4 parts

Methylene blue, enough to give the desired shade.

Dissolve the borax in the water; the shellac in the alcohol. Bring the borax solution nearly to a boil, add the shellac solution under constant stirring and add the methylene blue.

Metal goods to be lacquered must be perfectly clean, especially free from grease; they must be warmed and handled with a cloth to avoid finger touches. Apply the lacquer with a soft camel's hair brush, using the tip only. Apply 2 to 3 coats, letting each coat dry perfectly. Warm the articles between the varnishing.

Metal Lacquer; to Be Used Without Heat.

Shellac	5 parts
Gamboge	5 parts
Acetone	30 parts
Alcohol	50 parts

The lacquering must be done in a warm room, free from moisture. Two or more days should be allowed for perfect drying.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ETCHING.

Steel.—

Copper sulphate	24 parts
Alum	12 parts
Sodium chloride	3 parts
Acetic acid	12 parts
Nitric acid	1 part
Water, enough to make	120 parts

Mix the acids and the water, and dissolve the solid ingredients in the mixture. Dip the article in boiling water, wipe dry, and either dip into melted beeswax or rub wax on the article, while it is still hot enough to melt it. The design is produced by scratching with a fine pointed instrument through this film of wax. Apply the mixture with a piece of wood, wash off in a few minutes and repeat the process until the etching is of sufficient depth.

The same procedure holds good for the etching of the color substances given below:

Brass and Copper.—

Mix equal parts of the following solutions when needed:

1.

Nitric acid	16 parts
Water	100 parts

2.

Potassium chlorate	6 parts
Water	100 parts

Zinc.—

Mix equal parts of the following solutions when needed:

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

1.

Gallic acid	5 parts
Gum arabic	40 parts
Water	500 parts

Warm the mixture until solution takes place.

2.

Nitric acid	½ part
Copper sulphate	2 parts
Water	500 parts

Glass.—

Hydrofluoric acid, a sufficient quantity.

Apply with a glass rod.

Diamond Ink.

Ammonium fluoride	1 part
Barium sulphate	3 parts

Add sufficient sulphuric acid to make a stiff paste.

Wood.—

First cover the surface to be etched with good varnish, and let dry. With a needle point or any similar sharp instrument, draw the lines to be etched, through the layer of varnish, and apply to the design a liquid made as follows:

Potassium bichromate	1 part
Distilled water	6 parts
Sulphuric acid	1 part

Dissolve the bichromate in the water, and add the acid. Let remain in contact until the etching is deep enough to suit, then wash off. The varnish can be removed with any suitable solvent—benzol, alcohol, etc.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER VI.

PREPARATIONS FOR THE MOUTH AND TEETH.

The remedies intended for the mouth and teeth may be conveniently divided into those prescribed for specific diseased conditions and those used as hygienic cosmetics for daily use. The object of the hygienic care of the oral cavity is to keep the mouth and teeth in a healthy condition. This object may be attained by the proper employment of mechanical and chemical methods. The mechanical cleansing of the mouth and teeth by means of the brush, toothpick, floss silk, powder, paste, etc., will always be the fundamental principle of oral hygiene. Mechanical cleansing alone is not, however, sufficient, and the additional use of antiseptic solutions is essential to obtain the best results. Food remnants and slimy adhesions between and on the teeth, which form a favorable pabulum for the micro-organisms, together with a large number of the adherent bacteria, are removed by mechanical cleansing. Mouth washes are employed for the sole purpose of keeping the oral tissues in a healthy condition. They must favor the recovery of inflamed mucous membrane, which is so frequently present in a mild degree, and they must be sufficiently antiseptic to inhibit the growth of fission fungi and pathogenic bacteria.

A good antiseptic mouth wash should possess the following properties:

1. It must be absolutely indifferent in regard to (a) the mucous membrane of the mouth, i. e., it must be non-

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

caustic; (b) the teeth—it must be non-decalcifying; (c) the organism as a whole, i. e., it must be non-poisonous.

2. It must have sufficient antiseptic action.

3. It must have a pleasant taste and odor.

These properties are, naturally, rarely found in combination, and yet each one is of importance. A mouth wash which has a disgusting taste is as ineffective as one which has no germicidal action. The great mass of the public will never be induced to practice oral hygiene that involves the use of an ill-tasting mouth wash.

In constructing a formula for a mouth preparation the following drugs must be avoided: Alum, charcoal, formaldehyde solution, iron salts, mineral acids (with the exception of boric acid), mercury salts, potassium salts, salicylic acid and salol, beet and cane sugars, and easily fermentable substances.

Preparations which are intended to exercise a definite function on the teeth and gums, the oral membrane, the tongue, the salivary glands, the tonsils, and, to some extent, on the breath are known as *oralia*. This term has, however, never been universally recognized; the physical nature of the preparation has created specific names for definite classes—solid or semi-solid tooth preparations are known as dentifrices, liquid tooth preparations are spoken of as collutoria, while liquids intended for the pharyngeal regions are known as gargles. Oral remedies are employed for the purpose of preserving and restoring the normal equilibrium of the oral tissues, and consequently, no specific pharmacological action is represented by each class of these preparations; they represent merely a combination of medicinal agents indicated for a clinical entity. According to their therapeutic indications, the drugs used in the mouth are grouped

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under abrasives, antacides, antiseptics, astringents, stimulants and correctives.

DRUGS USED IN THE MOUTH.

The following is a list of drugs which are employed in mouth and tooth preparations. The numbers indicate the percentage in which these substances are usually present in the finished preparation.

ABRASIVES.	Percent
Pumice stone	3 to 5
Cuttle fish bone	3 to 5
Soap	3 to 5
Cinchona bark	5
Orris root	10
Calamus root	10
Calcium carbonate, precipitated	60 to 100

ANTACIDS.	Percent
Sodium bicarbonate	5
Magnesium carbonate	10
Magnesium oxide	10
Calcium carbonate, precipitated	60 to 100

ANTISEPTICS.	Percent
Mercuric chloride	0.05 to 0.1
Formaldehyde solution	0.1 to 0.3
Sodium fluoride	1 to 3
Benzoic acid	0.5 to 1
Hydronaphthol	1 to 5
Resorcinol	1 to 5
Salol	3 to 5
Phenol	3 to 5

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Salicylic acid	3	to	5
Magnesium dioxide	5	to	10
Sodium perborate	5	to	10
Strontium dioxide	5	to	10
Boric acid	10	to	20
Sodium borate	10	to	50
Potassium chlorate	10	to	50
Hydrogen dioxide solution	10	to	100

ASTRINGENTS.	Percent		
Zinc chloride	0.05	to	0.1
Tannic acid	1	to	2
Benzoin			5
Catechu			5
Kino			5
Myrrh			5
Rhatany root	2	to	10

STIMULANTS.	Percent		
Oil of rose	0.1	to	0.5
Oil of ylang ylang	0.1	to	0.5
Thymol			0.5
Oil of geranium	0.5	to	1
Oil of cinnamon	0.5	to	1
Oil of peppermint			1
Menthol			1
Oil of cloves	1	to	2
Oil of eucalyptus	1	to	2
Oil of mountain pine	1	to	3
Camphor	1	to	3
Oil of wintergreen	1	to	5
Methyl salicylate	1	to	5
Alcohol	10	to	100

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CORRECTIVES.	Percent
Saccharin	0.0003
Cumarin	0.5 to 1
Vanillin	0.5 to 1
Glycerin	5 to 10
Sugar of milk	10

ACTION OF ANTISEPTICS IN THE MOUTH.

(According to W. D. Miller.)

DRUGS.	Dilution in which they can be employed in mouth.	Time in which the mouth becomes sterilized.
Acid benzoic	1 : 100	¼ minute
Acid boric	1 : 50	above 11 minutes
Acid salicylic	1 : 300	¾ to 1 minute
Eugenol	1 : 750	above 10 minutes
Hydronaphthol	1 : 1,500	above 15 minutes
Iodine trichloride	1 : 2,000	above 1¼ minutes
Lysol	1 : 200	above 5 minutes
Mercuric chloride	2 : 2,500	½ to ¾ minute
Oil of cinnamon	1 : 400	about 8 minutes
Oil of cloves	1 : 550	above 11 minutes
Oil of eucalyptus	1 : 625	above 8 minutes
Oil of mountain pine	1 : 360	above 19 minutes
Oil of peppermint	1 : 600	above 11 minutes
Oil of wintergreen	1 : 350	above 12 minutes
Phenol	1 : 100	above 5 minutes
Potassium chlorate	1 : 40	
Potassium permanganate	1 : 4,000	about 15 minutes
Saccharin	1 : 400	¾ minute
Solution aluminum acetate	1 : 20	above 5 minutes
Solution hydrogen dioxide	2 : 100	above 6 minutes
Thymol	1 : 2,000	above 5½ minutes

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MOUTH WASHES.

A mouth wash is usually prescribed as a gargle, to be used in conjunction with the toothbrush. The components of the wash should be so adjusted that one teaspoonful, mixed with a half tumberful of warm water (approximately 1 to 30), furnishes the correct proportions of its active ingredients intended for daily use. The gargling motion is produced by forcing air from the lungs through the fluid held posteriorly in the mouth. Powerful exercise of the muscles of the pharynx, the cheeks, and the lips are material adjuncts in forcing the fluid back and forth through the teeth. About one-half to one minute's gargling is the average time required for each mouthful, corresponding approximately to half to one fluidounce (15 to 30 c.c.) of liquid. Correct gargling is quite a difficult procedure; it cannot be accomplished by children and those afflicted with pharyngeal disturbances. Through incorrect gargling a quantity of the fluid is usually swallowed, or it merely turns about in the anterior part of the mouth. If the fluids contain alcoholic or volatile liquids, more or less of it is always absorbed.

A convenient way of spraying the oral cavity with a fluid antiseptic is readily accomplished by using an atomizer. This method of applying an antiseptic is especially of service before and after the removal of tartar and other operations about the mouth, in children and in those who cannot gargle. The atomizer bulb may be worked by hand or foot power, or, still better, by compressed air.

Tooth and mouth washes are usually dispensed in flint glass bottles stoppered with corks or metallic sprinkler tops. If the latter are used the contents of the bottle must not corrode the metallic top.

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COLORS FOR MOUTH WASHES.

Bright red	Tincture of cochineal
Reddish brown	Tincture of cudbear
Brown	Caramel solution
Golden yellow	Tincture of saffron
Green	Chlorophyl solution

ALKALINE MOUTH WASH.

Sodium bicarbonate	20 parts
Sodium benzoate	20 parts
Sodium borate	50 parts
Menthol	6 parts
Eucalyptol	3 parts
Alcohol	100 parts
Glycerin	200 parts
Water, enough to make	1,000 parts

GENERAL DIRECTIONS FOR PREPARING A MOUTH WASH: Dissolve the essential oils, eucalyptol, thymol, menthol, or other alcohol-soluble substance in the alcohol, mix the glycerin and the water and add the water-soluble substances; mix the two solutions, and if turbid add 20 parts of purified talc for each 1,000 parts of the finished product. Shake occasionally, and let stand for a week. Filter through paper.

ANATHERIN DENTIFRICE.

Red sandalwood	20 parts
Guaiac wood	10 parts
Myrrh	25 parts
Cloves	15 parts
Cinnamon	5 parts
Oil of cloves	1 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Oil of cinnamon	1 part
Alcohol	1,500 parts
Water	750 parts

ANTISEPTIC MOUTH WASH.

Boric acid	25 parts
Benzoic acid	1 part
Thymol	3 parts
Menthol	6 parts
Eucalyptol	5 parts
Oil of wintergreen	5 parts
Alcohol	250 parts
Glycerin	100 parts
Water, enough to make	1,000 parts

CHINOSOL MOUTH WASH.

Chinosol	1 part
Oil of peppermint	1 part
Water	40 parts
Alcohol	60 parts

EAU DE BOTOT.

Star anise seed	25 parts
Cinnamon, Ceylon	25 parts
Cloves	25 parts
Cochineal	10 parts
Potassium bitartrate	5 parts
Tannic acid	5 parts
Balsam of Peru	5 parts
Oil of peppermint	10 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

HYDROGEN DIOXIDE MOUTH WASHES.

1.

Resorcinol	50 parts
Zinc chloride	⅓ part
Menthol	5 parts
Thymol	2 parts
Alcohol, diluted	1,000 parts
Eucalyptol	¼ part
Camphor	¼ part
Oil of wintergreen	½ part
Alcohol	250 parts
Hydrogen dioxide solution	200 parts
Water, enough to make	1,000 parts

2.

Thymol	0.5 part
Menthol	0.5 part
Saccharin	0.5 part
Alcohol	70 parts
Hydrogen dioxide solution	120 parts

MILLER'S MOUTH WASHES.

1.

Thymol	1 part
Benzoic acid	12 parts
Tincture of eucalyptus	60 parts
Alcohol	400 parts
Oil of peppermint	3 parts

2.

Benzoic acid	60 parts
Tincture of rhatany	260 parts
Oil of peppermint	15 parts
Alcohol, enough to make	2,000 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PRUYN'S MOUTH WASH.

Phenol	2 parts
Boric acid	6 parts
Oil of cassia	2 parts
Oil of peppermint	½ part
Chloroform	2 parts
Alcohol	50 parts
Glycerin, enough to make	120 parts

RESORCINOL MOUTH WASH.

Boric acid	5 parts
Sodium borate	13 parts
Resorcinol	18 parts
Eau de cologne	100 parts
Water, enough to make	500 parts

SACCHARIN MOUTH WASH.

Saccharin	0.5 part
Sodium borate	4 parts
Alcohol	50 parts
Water	50 parts
Tincture of cochineal	½ part
Oil of peppermint	1 part

SAPONACEOUS MOUTH WASH.

White castile soap	25 parts
Glycerin	100 parts
Water	600 parts
Alcohol	400 parts
Oil of cloves	10 parts
Oil of peppermint	15 parts
Oil of wintergreen	25 parts
Oil of cassia	10 parts

Color with tincture of cochineal.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

THYMOL MOUTH WASH.

Thymol	15 parts
Benzoic acid	100 parts
Eucalyptol	30 parts
Oil of peppermint	5 parts
Oil of cloves	1 part
Oil of sage	1 part
Cumarin	½ part
Alcohol, enough to make	1,000 parts

Color with tincture of saffron.

TOOTH POWDERS.

Tooth powders, pastes and soaps are chiefly employed for the purpose of mechanically cleansing the accessible surfaces of the teeth. Their antiseptic effect on oral bacteria is of questionable value, as they remain hardly long enough in the mouth to enter into complete solution. Tooth powders or pastes should not contain gritty or fermentable substances or chemicals which act deleteriously on tooth structure. The wasting away of tooth tissues, usually referred to as erosion or abrasion, and which principally occurs upon the labial surfaces of the teeth, is largely the result of the continuous use of powders, pastes, etc., which contain more or less abrasive substances.

An acquaintance with the abrasive qualities of the ingredients entering into the make-up of tooth preparations is essential for the compounder. A microscopic examination of the more important powdered substances, together with a comparative knowledge of their physical and chemical composition, furnishes excellent information regarding their usefulness as components of dentifrices.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

THE ABRASIVES.

Prepared chalk (drop chalk, whiting, creta præparata, U.S.P.), a white amorphous powder, is calcium carbonate, purified by mechanical means. Prepared chalk is *not* precipitated chalk. Prepared chalk contains small quantities of silica, alumina and other impurities, and consists principally of the microscopic shells of many form of infusoria. The minute particles of prepared chalk are sufficiently hard and sharp to remove tooth substances when used in a dentifrice, and should therefore not be employed for such purposes.

Precipitated chalk (precipitated calcium carbonate, calcii carbonas præcipitatus, U. S. P.) is a fine white amorphous powder, prepared by chemical means. Depending upon the process of manufacture, various grades of fineness, weight and color are obtained. For the purpose of preparing tooth powders, pastes, etc., only the very finest bolted precipitated calcium carbonate is permissible.

Prepared oyster shells (concha præparata, testa præparata) are prepared from the boiled, cleansed and powdered shells of the oyster, *Ostrea edulis*. They consist principally of an impure calcium carbonate with variable quantities of calcium phosphate and small amounts of iodine, bromine, organic matter, etc. The powder usually emits a peculiar odor, reminding one of that of the sea. The abrasive power of powdered oyster shells is about equal to that of prepared chalk, and the same objection obtains as to their use as a tooth powder base as to the other.

Pumice stone (lapis pumicis) is a light, porous stone of volcanic origin, consisting chiefly of silica, with potash and soda. As may be expected from its composition, it is a powerful abrasive, and it should never enter into a tooth

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preparation intended for daily use. Even its temporary use in conjunction with precipitated chalk acts deleteriously on tooth structure.

Magnesium carbonate (magnesii carbonas, U. S. P.). Two forms of magnesium carbonate are known—the light and the heavy. The light preparation is usually employed for tooth powder. It has no abrasive or polishing action on tooth structure. As it is a voluminous powder, it is principally used to give bulk to tooth powders. Burnt magnesia (Magnesii oxidum, U.S.P.) is prepared from magnesium carbonate by calcination. It possesses no advantage over magnesium carbonate, and is rarely used at present as a component of dentifrice.

Cuttlefish bone (os sepiæ) is a calcareous substance found under the skin of the back of the cuttlefish, *Sepia officinalis*. It is composed of calcium carbonate, calcium phosphate, gluten and other substances, which are readily recognized by their peculiar putrid odor. The external hard skin and the internal soft deposits of the cuttlefish bone are ground together, forming a powder which is used as an abrasive.

Charcoal (carbo ligni,. U. S. P., carbo tiliæ) is a very fine black powder prepared from soft wood (linden wood). It is odorless and tasteless, and, when freshly prepared, readily absorbs offensive odors. Even the finest charcoal powder presents under the microscope a mass of sharp, crystalline cylinders which possess marked abrasive power. When used as a component in a tooth powder, the sharp particles imbed themselves in due time in the gum tissue, producing a distinct blue line near the margin, which may simulate the typical lead line found in lead poisoning. The gum tissue becomes tattooed by the charcoal, and nothing

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can remove this pigmentation but a surgical operation. Charcoal should not be used in a tooth powder preparation; it is often found in the so-called Chinese and Japanese tooth powders.

Powdered vegetable drugs—as calamus, rhatany, licorice, orris root, cinchona bark, sandalwood, myrrh, benzoin, etc.—have no place in tooth powders. As stated above, they are added to give flavor to the powder or to increase its bulk. The odor and taste of these substances are readily substituted by their respective essential oils or alcoholic extracts. The time a tooth powder remains in the mouth is not long enough to allow the active constituents of these substances to enter into solution. Their abrasive action is of no value, and, as these vegetable powders may be forced between the teeth and remain there for some time, the starch, which is one of their constituents, may give rise to acid fermentation. For flavoring tooth powders the essential oils of anise, cassia, cloves, wintergreen, ylang-ylang (cananga), etc., either alone or in suitable combinations, are available. If the delicate flavor of the violet (orris root), which apparently is appealing to refined taste, is wanted, the orris oil, tenfold, is to be recommended. This concentrated oil must be used very sparingly. A suitable flavoring combination of oils for tooth powder purposes may be prepared as follows:

Cumarin	$^1/_{10}$ part
Oil of orris (tenfold)	1 part
Oil of star anise	5 parts
Oil of cloves	15 parts
Oil of wintergreen (artificial)	80 parts
Oil of peppermint	150 parts

One part of this oil mixture added to from 50 to 75

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parts of tooth powder body imparts a sufficiently strong flavor.

Tooth powders are preferably dispensed in glass bottles or tin cans with suitable sprinkler tops.

BODIES FOR TOOTH POWDERS.

Red.

Carmine, No. 40	20 parts
Ammonia water	50 parts
Water	20 parts
Alcohol	30 parts
Calcium carbonate, precipitated	1,000 parts

Dissolve the carmine in the ammonia water, add the water and alcohol and mix thoroughly with the calcium carbonate. Spread on paper and dry at room temperature. Rub through a No. 50 brass wire sieve.

Pink.

Prepare same as red body, using only one-half of the carmine, i. e., 10 parts.

Violet.

Alkanin	2½ parts
Ether	100 parts
Calcium carbonate, precipitated	1,000 parts

Prepare same as red body.

COMMON SENSE TOOTH POWDER.

Calcium carbonate, precipitated	90 parts
Magnesium carbonate	5 parts
Castile soap	5 parts
Oil of orris (tenfold)	½ part

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CAMPHOR OR ENGLISH TOOTH POWDER.

Calcium carbonate, precipitated	720 parts
Magnesium carbonate	120 parts
Sugar of milk	130 parts
Camphor	20 parts
Ether	30 parts

Dissolve the camphor in the ether, mix with the calcium carbonate, dry in the air, and mix with the other ingredients.

FITZGERALD'S TOOTH POWDER.

Calcium carbonate, precipitated	360 parts
Magnesium carbonate	300 parts
Castile soap	150 parts
Salol	60 parts
Boric acid	30 parts
Thymol	2 parts
Saccharin	½ part
Oil of peppermint	5 parts

LASAR'S TOOTH POWDER.

Calcium carbonate, precipitated	100 parts
Sodium chloride	2½ parts
Pumice stone	2½ parts
Castile soap	3 parts
Oil of peppermint	1 part

MILLER'S TOOTH POWDER.

Calcium carbonate, precipitated	30 parts
Magnesium carbonate	10 parts
Orris root	15 parts
Oil of peppermint	⅔ part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

OXYDIZING TOOTH POWDERS.

1.

Calcium carbonate, precipitated	75 parts
Magnesium carbonate	10 parts
Sodium perborate	10 parts
Castile soap	3 parts
Oil of peppermint	1 part

2.

Calcium carbonate, precipitated	90 parts
Strontium dioxide	5 parts
Castile soap	3 parts
Oil of wintergreen	1 part
Oil of peppermint	½ part

3.

Magnesium oxide	50 parts
Calcium carbonate, precipitated	100 parts
Magnesium dioxide	20 parts
Menthol	2 parts
Saccharin	1 part
Oil of peppermint	2 parts

PEDLEY'S TOOTH POWDER.

Calcium carbonate, precipitated	1,000 parts
Orris root	250 parts
Castile soap	125 parts
Boric acid	125 parts
Phenol	30 parts
Oil of eucalyptus	25 parts

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POTASSIUM CHLORATE TOOTH POWDER.

Calcium carbonate, precipitated	500 parts
Potassium chlorate	250 parts
Sugar of milk	100 parts
Orris root	125 parts
Menthol	10 parts
Oil of cloves	5 parts

RED TOOTH POWDER.

Red tooth powder body	1,000 parts
Orris root	300 parts
Sugar of milk	200 parts
Oil of cloves	50 parts
Oil of peppermint	50 parts

FLETCHER'S VEGETABLE TOOTH POWDER.

Pulverized cereal	75 parts
Sodium borate	18 parts
Potassium chlorate	7 parts

Sweeten with saccharin and flavor to taste.

VIOLET TOOTH POWDER.

Violet tooth powder body	650 parts
Sugar of milk	100 parts
Orris root	200 parts
Licorice root	25 parts
Cumarin	¼ part
Extract of jasmine	10 parts
Oil of rose	1 part

TOOTH PASTES.

A perfectly satisfactory paste cannot be produced without the use of gelatin or mucilage of acacia. Pastes which

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are massed with pure glycerin are disappointing; they ooze from the tube, discoloring the label, forming an unsightly package. Glycerin is necessary, but it should not be employed alone. Glucose should never be used as a massing fluid, as it will easily ferment. The consistency of the excipient or massing fluid determines the character of the paste. If formaldehyde solution is added to a gelatin massing fluid, the gelatin is changed to an insoluble compound, and the paste in due time becomes hard as a rock. Small quantities of tooth paste may be made in a large wedgewood mortar; for making pastes upon a commercial scale an ordinary dough mixer (as used in bakeries) is indispensable. The so-called "heavy" precipitated chalk is to be preferred as a base for the tooth paste body.

MASSING FLUIDS.

Gelatin	1 part
Glycerin	30 parts
Water	35 parts

Soak the gelatin in the water, apply gentle heat, and add the glycerin.

Another massing fluid is made by mixing

Glycerin	2 parts
Mucilage of acacia	2 parts

Mucilage of acacia is made by dissolving

Gum arabic	4 parts
Water	6 parts

Dissolve the gum arabic in the water and strain through fine cotton cloth.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Tooth pastes may be prepared according to the following general formula:

Tooth paste body..... 1 part
Massing fluid .....3 to 4 parts

The amount of massing fluid depends upon the tooth paste body and upon the season of the year. In cold weather a larger quantity is required than during the summer months. Tooth paste bodies containing large quantities of vegetable drugs also require large amounts of massing fluid. After the tooth paste body is thoroughly mixed with the massing fluid into a rather stiff paste, it should stand for at least four days. It should be beaten up every day in the dough mixer for about fifteen minutes, and each time very small quantities of glycerin are added to it, until finally the right consistency is reached. At the last mixing the paste should just drop from a spatula when held in a perpendicular position.

Tooth pastes are to be dispensed in collapsible tubes made of pure tin. Tin boxes or porcelain dishes are poor substitutes for the tubes, as they invite contamination of the paste. The filling of the tubes is best accomplished by using a special filling apparatus worked by hand-power or compressed air. The ends of the tubes are closed by a special folding punch.

TOOTH PASTE BODIES.

Any tooth powder, unless it contains substances which are decomposed by moisture (i. e., certain oxygen tooth powders), may be worked into a paste. A suitable tooth paste body may be made according to the following formula:

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Heavy precipitated chalk	75 parts
Powdered castile soap	10 parts
Powdered orris root	5 parts
Saccharin	3/100 parts
Flavoring oils	1 part

The chalk may be colored pink, according to instructions as given under tooth powders.

A suitable flavoring oil mixture may be prepared according to the following formula:

Oil of star anise	1 part
Oil of cloves	3 parts
Oil of wintergreen	16 parts
Oil of peppermint	24 parts
Cumarin	1/300 part

HARLAN'S TOOTH PASTE.

Calcium carbonate, precipitated	1,500 parts
Sodium fluo-silicate	250 parts
Tannic acid	30 parts
Sugar	750 parts
Cuttlefish bone	250 parts
Oil of wintergreen	20 parts

Massing fluid, enough to make a paste.

ENGLISH ODONTINE.

Calcium carbonate, precipitated	500 parts
Orris root	100 parts
Pumice stone	50 parts
Oil of peppermint	10 parts
Oil of sage	5 parts
Oil of cloves	2 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Carmine, enough to color.
Massing fluid, enough to make a paste.

KALADONT.

Calcium carbonate, precipitated	250 parts
Magnesium carbonate	80 parts
Castile soap	100 parts
Oil of peppermint	10 parts
Oil of cloves	2 parts
Oil of cinnamon	1 part
Oil of wintergreen	1 part

Carmine, enough to color.
Massing fluid, enough to make a paste.

MILLER'S TOOTH PASTE.

Calcium carbonate, precipitated	100 parts
Magnesium carbonate	5 parts
Cuttlefish bone	4 parts
Sugar	2 parts
Myrrh	2 parts

Massing fluid, enough to make a paste.

TOOTH PASTE "KOLYNOS"; JENKINS.

Soap	33 parts
Calcium carbonate, precipitated	25 parts
Absolute alcohol	20 parts
Glycerin	15 parts
Benzoic acid	3 parts
Oil of eucalyptus	2 parts
Oil of peppermint	2 parts
Saccharin	½ part
Thymol	½ part

Make into a paste.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

POTASSIUM CHLORATE TOOTH PASTE.

Calcium carbonate, precipitated	350 parts
Orris root	100 parts
Potassium chlorate	250 parts
Oil of peppermint	5 parts
Oil of cloves	2 parts
Oil of wintergreen	1 part

Massing fluid, enough to make a paste.

TOOTH PASTE WITH CARLSBAD SALTS.

Artificial Carlsbad salt	1 part
Powdered castile soap	1 part
Calcium carbonate, precipitated	3 parts

Massing fluid, enough to make a paste.

TOOTH PASTE WITH ORRIS ROOT.

Precipitated calcium carbonate, "pink"	450 parts
Powdered orris root	100 parts
Powdered castile soap	50 parts
Oil of peppermint	10 parts
Oil of sage	5 parts
Oil of cloves	5 parts

Massing fluid, enough to make a paste.

SALOL TOOTH PASTE.

Precipitated calcium carbonate, heavy	350 parts
Powdered orris root	150 parts
Sugar of milk	100 parts
Powdered castile soap	50 parts
Salol	20 parts
Oil of peppermint	5 parts
Oil of cloves	3 parts

Massing fluid, enough to make a paste.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

TOOTH PASTE WITH PUMICE STONE.

Precipitated calcium carbonate, "pink".	400 parts
Powdered orris root	100 parts
Powdered pumice stone	50 parts
Powdered castile soap	150 parts
Oil of peppermint	15 parts
Oil of lemon	3 parts
Oil of cassia	3 parts
Oil of sage	1 part

HARD TOOTH PASTES OR TOOTH SOAPS.

Tooth soaps are usually prepared by incorporating about 20 percent of castile soap in alcoholic solution into the powder base and pressing the mass into suitable molds; their hardness increases with age. Tooth soaps are usually dispensed in flat tin boxes, china jars, or wrapped in tinfoil.

AUSTRIAN TOOTH SOAP.

Castile soap	200 parts
Calcium carbonate, precipitated	80 parts
Carmine	2 parts
Oil of peppermint	5 parts
Alcohol	30 parts

BERGMANN'S TOOTH SOAP.

Transparent glycerin soap	50 parts
Sugar	25 parts
Alcohol	20 parts
Water	10 parts
Oil of peppermint	1 part

Dissolve the soap and sugar in the alcohol.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

KOBERT'S TOOTH SOAP.

Magnesium carbonate	50 parts
Orris root	50 parts
Talcum	50 parts
Castile soap	50 parts
Oil of wintergreen	3 parts

THYMOL TOOTH SOAP.

Pink tooth powder body	750 parts
Castile soap	200 parts
Glycerin	50 parts
Alcohol	100 parts
Thymol	10 parts
Cumarin	½ part
Menthol	10 parts
Oil of cloves	5 parts

The soaps, glycerin and alcohol are mixed to a paste and the other ingredients are incorporated. Press in suitable molds, expose to the air for twenty-four hours, and paint the pieces with tincture of benzoin to give gloss to the finished product.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER VII.

PHARMACEUTICAL COMPOUNDS.

LOCAL ANESTHETIC SOLUTION; FISCHER.

Novocaine	1.5 parts
Sodium chloride	0.92 part
Thymol	0.06 part
Distilled water, enough to make	100 parts

To each 20 minims of this solution add one drop of adrenaline solution when needed.

NORMAL ANESTHETIC SOLUTION; BUENTE AND MORAL.

Novocaine	1.5 parts
Sodium chloride	0.92 part
Thymol	0.02 part
Distilled water, enough to make	100 parts

To each 20 minims of this solution add one drop of adrenaline solution when needed.

NOVOCAINE SOLUTION.

Novocaine	1.5 parts
Sodium bicarbonate, C. P.	0.4 part
Sodium chloride, C. P.	0.4 part
Distilled water, enough to make	100 parts

To each 20 minims of this solution add one drop of adrenaline solution when needed.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ANESTHETIC SOLUTIONS; SCHLEICH.

1.

Cocaine hydrochloride	0.2	part
Sodium chloride	0.2	part
Morphine hydrochloride	0.02	part
Distilled water, enough to make	100	parts

2.

Cocaine hydrochloride	0.1	part
Sodium chloride	0.2	part
Morphine hydrochloride	0.02	part
Distilled water	100	parts

3.

Cocaine hydrochloride	0.01	part
Sodium chloride	0.2	part
Morphine hydrochloride	0.005	part
Distilled water	100	parts

COCAINE ANESTHETIC SOLUTION.

Cocaine hydrochloride	5	parts
Sodium chloride	4	parts
Sterilized water	480	parts

To each syringeful (20 minims) add one drop of adrenaline chloride solution, when used.

COCAINE ANESTHETIC SOLUTION; WYCKOFF.

Cocaine hydrochloride	4	parts
Solution trinitrin (1 percent)	10	parts
Spirit thymol comp	120	parts
Distilled water, enough to make	480	parts

[The spirit thymol comp. is composed of benzo-

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

boric acid, thymol, eucalyptol, oil of wintergreen, oil of peppermint, with extract of witch-hazel, alcohol, and distilled water.]

TROPACOCAINE ANESTHETIC SOLUTION.

Tropacocaine hydrochloride	20 parts
Sodium chloride	5 parts
Distilled water	480 parts

Boil and filter.

NOVOCAINE COMPOUND TABLETS.

Novocaine	1/3 grain
Suprarenine hydrochloride	1/1200 grain
Sodium chloride	1/8 grain

One tablet dissolved in 20 minims of sterile water makes a 2 percent solution of novocaine ready for immediate use.

HEMOSTATIC LOCAL ANESTHETIC SOLUTION; LEGRAND.

Gelatin	2 parts
Sodium chloride	0.7 part
Phenol crystals	0.1 part
Eucaine B	0.7 part
Cocaine hydrochloride	0.3 part
Distilled water, enough to make	100 parts

TO RELIEVE PAIN AFTER EXTRACTION.

I.

Menthol	2 parts
Phenol liquid	2 parts
Tincture of iodine	2 parts
Ether	30 parts
Chloroform	30 parts

Apply on cotton to the painful alveolar socket.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Orthoform powder ..... 1 part

Roll absorbent cotton to a cone, dip in carbolated water, and cover with orthoform powder; insert the cone into the painful alveolar socket.

ANESTHETIC AND ANTISEPTIC PASTE FOR SCALING TEETH.

Phenol liquid	10 parts
Cocaine hydrochloride	10 parts
Menthol	25 parts
White vaseline	480 parts

Before scaling the teeth, rub the paste into the spaces between the teeth and on the gum.

EUROFORM PASTE; BUCKLEY.

Orthoform	60 parts
Europhen	90 parts
Petronol	135 parts
Petrolatum	125 parts

LOCAL ANESTHETIC FOR PYORRHEA ALVEOLARIS; PATTERSON.

Cocaine hydrochloride	20 parts
Oil of cloves	8 parts
Oil of cassia	8 parts
Menthol	8 parts
Chloroform	480 parts

Before removing deposits from roots, saturate pellet of cotton with solution, crowd gently into pockets, and allow to remain for a few moments. Keep well stoppered.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

LOCAL ANESTHETIC FOR EXPOSED PULPS.

1; Gertzen.

Sodium bicarbonate	10 parts

Phenol liquid, enough to make a creamy paste.

2; Pincemaille.

Cocaine hydrochloride	1 part
Chloroform	5 parts
Phenosalyl	25 parts
Oil of lavender	10 parts
Oil of cloves	20 parts
Oil of cinnamon	25 parts

COMPOUNDS FOR DEVITALIZING THE PULP.

Arsenical Pastes.

1.

Arsenic trioxide	20 parts
Cocaine hydrochloride	10 parts

Glycerin, enough to make a paste.

2.

Arsenic trioxide	1 part
Orthoform	1 part

Lanolin, enough to make a paste.

3.

Arsenic trioxide	20 parts
Cocaine hydrochloride	20 parts
Menthol	5 parts

Glycerin, enough to make a paste.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

4.

Arsenic trioxide	20 parts
Thymol	20 parts

Oil of cloves, enough to make a paste.

5.

Arsenic trioxide	90 parts
Cocaine hydrochloride	40 parts
Phenol crystals	10 parts

Lanolin, enough to make a paste.

6.

Arsenic trioxide	5 parts
Tannic acid	2 parts
Morphine acetate	10 parts

Oil of cloves, enough to make a paste.

7.

Crude cobalt	80 parts
Cocaine hydrochloride	20 parts

Phenol liquid, enough to make a paste.

8.

Arsenical Fibre.

Arsenic trioxide	5 parts
Tannic acid	2 parts
Morphine acetate	10 parts

Phenol liquid, enough to make a thin paste.

Mix with sufficient fine cross-cut absorbent cotton fibers until the paste is fully absorbed; dry, and keep in a well-covered glass jar.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

9.

Arsenical Discs.

Arsenic trioxide,
Cocaine hydrochloride .....equal parts
Oil of cloves, enough to make a soft paste.

Cut small squares (one to one and one-half millimeters) of hard white blotting paper, saturate with the paste, let dry for a few hours, and then put into a glass stoppered bottle.

PULP DIGESTANT; HARLAN.

Papain	1 part
Glycerin	1 part
Solution hydrochloric acid (1:100) ...	1 part

Make a paste, apply to the dead pulp, and seal into the cavity for two weeks, at the end of which time the pulp will be digested. First destroy the pulp with arsenic left in the tooth for two or three days. Remove the arsenic, cut away the bulbous portion of the pulp, and introduce the paste as above. The pulp is reduced to a jelly-like mass resembling glue, and is easily removed.

STYPTICS.

Styptic Cotton.

1.

Alum	12 parts
Solution of iron perchloride.....	12 parts
Water	75 parts
Absorbent cotton	50 parts

Dissolve the alum in the water and add the solution of iron perchloride. Pour the solution over the cotton in such a way that all is absorbed. Afterwards, by means of a

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

press, squeeze the damp cotton until the solution is evenly distributed, and then dry.

2.

Solution of iron chloride	60 parts
Alcohol	60 parts
Mix and saturate	
Absorbent cotton	40 parts

Dry in a dark closet and preserve in dark colored glass jars.

Styptic Mixture.

Phenol-sulphonic acid	12 parts
Alcohol	4 parts
Benzoic acid	1 part
Tannic acid	1 part
Glycerin	12 parts
Rose water	56 parts

For external use.

BONE CAVITY PASTES.

1.

Bone Plombe; Mosetig-Mayrhofer.

Iodoform	10 parts
Oil of sesame	15 parts
Spermaceti	30 parts

Melt the spermaceti and the oil of sesame in a porcelain capsule over a low flame, and when the mixture starts to congeal, stir in the iodoform.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

BECK'S BISMUTH PASTES.

Soft Paste.

Bismuth subnitrate (free from arsenic)	33 parts
Vaseline (yellow or white)	67 parts

Hard Paste.

Bismuth subnitrate	30 parts
Vaseline	60 parts
Paraffin (melting point 120° F.)	5 parts
White wax	5 parts

Place the vaseline, paraffin and white wax in an enameled vessel, bring to a boil, and add the bismuth under constant stirring until the paste becomes solid.

PLASTIC INJECTION FOR PYORRHEA POCKETS.

Menthol	3 parts
Hydronaphthol	15 parts
White wax	240 parts
Vaseline	480 parts

SEAL FOR PYORRHEA POCKETS.

1; Rhein.

Gum lac, purified	135 parts
Gum benzoin, purified	5 parts
Phenol crystals	50 parts
Oil of cinnamon	3 parts
Saccharin	3 parts
Alcohol, enough to make	500 parts

After the removal of all deposits and the application of a stimulating escharotic, covering with this soothing appli-

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

cation will keep the pockets sealed for many hours, and will be found beneficial from its therapeutic properties.

2; Steresol.

Shellac	270 parts
Gum benzoin	10 parts
Balsam of Tolu	10 parts
Phenol crystals	100 parts
Oil of cinnamon	6 parts
Saccharin	6 parts
Alcohol, enough to make	1,000 parts

COUNTER-IRRITANTS.

Iodo-Glycerol; Talbot.

Zinc iodide	15 parts
Distilled water	10 parts
Iodine	25 parts
Glycerin	50 parts

Dissolve the zinc iodide in the distilled water, add the iodine, stir with a glass rod until dissolved, and, lastly, add the glycerin.

Compound Iodine Solution; Harlan.

Iodine	24 parts
Potassium iodide	24 parts
Tincture of aconite root, Fleming's	12 parts
Alcohol	48 parts
Chloroform	48 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Pyorrhea Astringent; Buckley.

Potassium iodide	60 parts
Iodine	80 parts
Zinc phenolsulphonate	60 parts
Water	192 parts
Glycerin	100 parts

Aromatic Tincture of Iodine and Aconite; Witzel.

Eucaine	5 parts
Tincture of iodine	65 parts
Tincture of aconite	32 parts
Eugenol	3 parts

Stronger Tincture of Aconite.

(For external use only.)

Fluid extract aconite root	2 parts
Alcohol	2 parts

Iodine Paint; Carson.

Iodine	1 part
Alcohol	8 parts

This solution is allowed to stand in a glass-stoppered bottle for several months before using.

Iodine Caustic; Churchill.

Iodine	35 parts
Potassium iodide	70 parts
Water	150 parts

Stable Tincture of Iodine.

Iodine	1 part
Alcohol	12 parts
Sodium borate	2 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Decolorized Tincture of Iodine.

Iodine	20 parts
Sodium thiosulphate	20 parts
Distilled water	20 parts

Put the ingredients in a bottle and place the bottle in a vessel surrounded by cold water. Shake occasionally until solution is completed. Add in small portions:

Water of ammonia	32 parts
and	
Alcohol	150 parts

Let stand for eight days and filter.

Refrigerant Counter-Irritant; Buckley.

1.

Menthol	10 parts
Iodine	10 parts
Chloroform	75 parts
Tincture of aconite, U. S. P.	375 parts

2.

Chloroform	3 parts
Tincture of aconite	5 parts
Tincture of iodine	10 parts

Chloroform Liniment.

Gum camphor	6 parts
Ether	12 parts
Alcohol	48 parts
Chloroform	100 parts

For external use only.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Dental Liniment; Buckley.

Menthol	20 parts
Chloroform	75 parts
Tincture of aconite, U. S. P., enough to make	480 parts

For external use only.

Dental Liniment; Hoff.

Chloroform	8 parts
Ether	8 parts
Menthol	4 parts
Spirit of camphor	4 parts
Spirit of rosemary	8 parts
Water of ammonia	20 parts
Tincture of capsicum	20 parts

For external use only.

Capsicum Plaster.

Caoutchouc	10 parts
Paraffin	1 part

Heat carefully until just liquefied, and add under constant stirring

Rosin	10 parts
Orris root, powdered	4 parts
Capsicum, powdered	4 parts

Spread thinly on linen and after trying, cut in small pieces. Dry the gum thoroughly before applying.

Capsicum Bags.

Powdered capsicum	2 parts
Powdered ginger	2 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Fill small muslin bags with the mixture and cover one side with rubber dam. The muslin side of the bag is placed against the gum.

Balsam Analgesique; Bengue.

Menthol	10 parts
Methyl salicylate	10 parts
Lanolin	15 parts

ANTISEPTIC COMPOUNDS.

Iodine Caustic.

Iodine	1 part
Creosote	3 parts

Phenol Compound; Buckley.

Menthol	1 part
Thymol	2 parts
Liquid phenol	9 parts

Camphorated Phenol.

Phenol crystals	3 parts
Camphor	6 parts
Alcohol	1 part

Iodized Phenol.

Iodine	2 parts
Phenol	6 parts
Glycerin	2 parts

Phenosalyl.

Phenol crystals	90 parts
Lactic acid	20 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Salicylic acid	10 parts
Eucalyptol	5 parts
Menthol	1 part

Phenol Sodique.

Phenol crystals	30 parts
Sodium hydrate	2 parts
Water	28 parts

Dissolve the sodium hydrate in the water, add the phenol and warm gently.

Compound Solution of Cresol.

Soft soap (U. S. P.)	350 parts
Distilled water	150 parts

Place on a water bath and stir until homogeneous.

Add

Cresol, U. S. P.	500 parts

Stir until liquid.

Saponated Tincture of Cresol.

Cresol	350 parts
Soft soap	450 parts
Alcohol, enough to make	1,000 parts

Eucalpytol Compound; Buckley.

I.

Menthol	64 parts
Thymol	96 parts
Eucalyptol, enough to make	2,000 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Camphor	1 part
Phenol	1 part
Oil of Eucalyptus, enough to make	10 parts

Thymophene.

Phenol crystals	2 parts
Thymol	2 parts

Place the thymol in a dry bottle, melt the phenol and pour it over the thymol. The resultant solution will remain liquid.

Thymocamphene.

Phenol crystals	2 parts
Thymol	2 parts
Camphor	1 part

Place the thymol and the camphor in a dry bottle, melt the phenol and pour it over the mixture. The resultant solution will remain liquid.

Geranium—Formol.

Formaldehyde solution	40 parts
Oil of geranium	20 parts
Alcohol	40 parts

Formocresol; Buckley.

Tricresol	2 parts
Formaldehyde solution	2 parts

1-2-3 Mixture; Black.

Oil of Cassia	1 part
Phenol crystals	2 parts
Oil of wintergreen	3 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Solution of Chlorinated Soda Compound; Lepkowsky.

(For the treatment of infected root canals.)

Solution of chlorinated soda.....	9 parts
Solution of sodium hydroxide.....	1 part

Compound Chloral Solution; Baumgartner.

(For the treatment of infected root canals.)

Chloral hydrate	50 parts
Water	25 parts
Diluted hydrochloric acid,.....	25 parts

Mono-Chlor-Phenol Compound.

(For the treatment of infected root canals.)

Thymol	1 part
Mono-chlor-phenol	3 parts
Potassium hydroxide	1 part

Melt the thymol and the mono-chlor-phenol in a test tube and add to it the potassium hydroxide. Carefully heat over a low Bunsen flame until a perfect solution is obtained. Immediately transfer to small, perfectly dry bottles and protect with a paraffin stopper.

Phenol-Sulphonic Acid.

Phenol, liquid.....	45 parts
Sulphuric acid, strong.....	40 parts
Heat to about 150° F. for several days and add	
Distilled water, enough to make.....	100 parts

Mercuric Bichloride Antiseptic Solution.

Bernay's antiseptic tablet.....	1 part
Solution of hydrogen dioxide.....	120 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Antiseptic Solution; Dobell.

Sodium borate	240 parts
Sodium bicarbonate	240 parts
Phenol, liquid	48 parts
Glycerin	480 parts
Water, enough to make	15,000 parts

Antiseptic Solution; Thiersch.

Salicylic acid	4 parts
Boric acid	12 parts
Water	1,000 parts

Extemporaneous Solutions of Hydrogen Peroxide.

Extemporaneous solutions of hydrogen peroxide may be prepared as follows:

2 Percent (by volume) Solution.

Sodium perborate	25 parts
Boiling distilled water, enough to make	1,000 parts

Filter, if necessary.

5 Percent (by volume) Solution.

Sodium perborate	65 parts
Tartaric, or citric acid, powdered	21 parts
Boiling distilled water, enough to make	1,000 parts

Filter, if necessary.

10-12 Percent (by volume) Solution.

Sodium perborate	170 parts
Tartaric, or citric acid, powdered	60 parts
Boiling distilled water, enough to make	1,000 parts

Filter, if necessary.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

18-20 Percent (by volume) Solution.

Sodium perborate	210 parts
Tartaric, or citric acid, powdered	105 parts
Boiling distilled water, enough to make	1,000 parts

These aqueous solutions of sodium perborate produce a hydrogen peroxide solution which always reacts alkaline.

To Preserve Hydrogen Peroxide Solution.

Solution hydrogen peroxide	1,000 parts
Acetanilide	1 part

Keep in well-stoppered bottles.

Black Zinc Chloride Solution; Witzel.

Zinc chloride	10 parts
Phenol liquid	5 parts
Alcohol	5 parts
Chloroform	1 part
Oil of peppermint	1 part
Oil of cloves	1 part

Aromatized Iodoform.

Iodoform	96 parts
Cumarin	4 parts

Iodoform Emulsion.

Iodoform	5 parts
Mucilage of gum arabic	2½ parts
Glycerin	15 parts
Water, enough to make	60 parts

Iodoform Wax.

Iodoform	1 part
Hard paraffin	1 part

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid Iodoform.

Potassium hydroxide	35 parts
Water	25 parts
Oleic acid	50 parts
Alcohol, 95 percent	30 parts
Iodine	30 parts

Dissolve the potassium hydroxide in the water, then pour the oleic acid and alcohol into this solution of potassa. With continued stirring add the iodine, and, finally, a few drops of potassium hydroxide solution to discharge the reddish color of the liquid. Let the mixture stand for several days in a dark place, when it will separate into well-defined layers. The upper aqueous layer is decanted. The lower layer is a syrupy liquid, having a pronounced yellow color and a strong odor of iodoform.

Aristol Oil Solution.

Aristol	1 part
Oil of sesame	9 parts

Mix and let stand undisturbed for one-half hour. Then repeatedly shake during the next ten hours, set aside for three or four days and pour off the clear solution.

Soluble Antiseptic Powder.

Salicylic acid	75 parts
Phenol crystals	15 parts
Eucalyptol	15 parts
Menthol	15 parts
Thymol	15 parts
Zinc sulphate	2,000 parts
Boric acid, in impalpable powder	18,000 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ROOT CANAL FILLING MATERIALS.

1: Scheuer.

Zinc oxide	8 parts
Zinc sulphate	2 parts
Cresol	3 parts
Solution of formaldehyde	1 part
Eugenol	1 part

Glycerin, enough to make a stiff paste.

2.

Zinc oxide	225 parts
Zinc sulphate	75 parts
Oil of peppermint	1 part

Lysoform, enough to make a paste.

3.

Iodoform	90 parts
Zinc oxide	45 parts
Charcoal, powdered	45 parts

Oil of cloves, enough to make a paste.

4.

Cresol	60 parts
Formaldehyde solution	15 parts
Glycerin	10 parts
Zinc oxide	10 parts

Boric acid, enough to make a stiff paste.

5.

Gutta-percha base plate	60 parts
Rosin	60 parts
Chloroform	240 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

6; Eucapercha Compound; Buckley.

Dental base plate gutta percha.....	5 parts
Eucalyptol compound (see page xx)...	5 parts

Make solution by aid of heat, avoiding the loss of eucalyptol.

7; Eucalyptol Gutta Percha.

Thymol	1 part
Gutta percha base plate.....	99 parts
Eucalyptol	100 parts

Melt together in a porcelain capsule by carefully heating on a water bath.

8.

Powder.

Thymol	5 parts
Dried alum.....	10 parts
Kaolin	25 parts

Liquid.

Formaldehyde solution.....	1 part
Cresol	2 parts
Alcohol	3 parts

Mix to a stiff paste before using.

9.

Powder.

Thymol	5 parts
Dried alum.....	10 parts
Kaolin	25 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid.

Formaldehyde solution	1 part
Cresol	2 parts
Alcohol	3 parts

10.

Powder.

Paraform	4 parts
Iodoform	1 part
Thymol	1 part
Zinc oxide	14 parts
Tannic acid	20 parts

Liquid.

Phenol	5 parts
Oil of cloves	5 parts
Oil of cinnamon	5 parts
Glycerin	5 parts

11.

Powder.

Zinc oxide	8 parts
Zinc sulphate, exsiccated	2 parts

Liquid.

Cresol	3 parts
Formaldehyde solution	1 part
Eugenol	1 part

12.

Powder.

Hydronaphthol	1 part
Zinc oxide	2 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid.

Hydronaphthol	2 parts
Alcohol	36 parts
Oil of cloves	12 parts

13.

Powder.

Zinc oxide	20 parts
Paraform	5 parts

Liquid.

Zinc sulphate	6 parts
Water	20 parts
Cresol	1 part

14; Wakefield.

Powder.

Alum	2 parts
Thymol	4 parts
Zinc oxide	240 parts

Liquid.

Formaldehyde solution	2 parts
Alcohol	4 parts
Creosote	90 parts

15.

Powder.

Xeroform	5 parts
Thymol	1 part
Dried alum	3 parts
Zinc oxide	5 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid.

Eugenol	5 parts
Cresol	5 parts

16; Formagen; Abraham.

Powder.

Fresh slaked lime	10 parts
Zinc oxide	20 parts
Quartz	20 parts
Kaolin	50 parts

Liquid.

Formaldehyde solution	1 part
Oil of cloves	2 parts
Creosote	3 parts
Alcohol	4 parts

Mix to a stiff paste before using.

17; Eucaine-Formol-Phenol Paste; Witzel.

Powder.

Eucaine	3 parts
Phenol liquid	5 parts
Paraform	10 parts
Zinc oxide	10 parts

Liquid.

Eugenol	10 parts
Formaldehyde solution	40 parts
Glycerin	50 parts

Mix to a stiff paste before using.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

18; Oxpara; Jones.

Powder.

Thymol	1 part
Zinc oxide	2 parts

Liquid.

Glycerin	1 part
Formaldehyde solution	1 part
Tricresol	3 parts

19; Dodel.

Paraffin	48 parts
Salol	12 parts

Melt the paraffin on a water-bath, remove from the fire and add the salol with constant stirring.

20.

Hard paraffin	48 parts
Aristol	6 parts

Prepare as above.

21.

Thymol	1 part
Crocus martis	15 parts
Hard paraffin	84 parts

Prepare as above.

22; Dunning.

Paraform	2 parts
Bismuth subnitrate	8 parts
Paraffin	8 parts

Prepare as above.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

23. Disappearing Root Filling; Ferris.

Isinglass	60 parts
Tannic acid	1½ parts
Tricresol	4 parts
Distilled water	90 parts

When heated to a temperature of 100° F. in an ordinary gluepot or water bath, it becomes syrupy and can be readily introduced into the root canals with a piece of sterile catgut. If the canal be large the catgut may be left in the canal. A ball of stiff phosphate of zinc is then pressed into the pulp chamber, forcing the mixture through the canal and fistula.

PULP MUMMIFYING PASTES.

1; Soederberg.

Alum	1 part
Thymol	1 part
Glycerin	1 part

Zinc oxide, enough to make a paste.

2.

Paraform	1 part
Thymol	1 part
Zinc oxide	2 parts

Glycerin, enough to make a paste.

3.

Cocain hydrochloride	1 part
Thymol	1 part
Formaldehyde solution	1 part
White vaselin	3 parts
Zinc oxide	7 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PULP CAPPING MATERIALS.

1.

Aristol, or europhen	1 part
Calcium phosphate	10 parts

Eugenol, enough to make a creamy paste.

2.

Thymolized Calcium Phosphate; Buckley.

Thymol	10 parts
Calcium phosphate, precipitated	438 parts

3.

Gum benzoin	3 parts
Balsam of tolu	2 parts
Eugenol	2 parts
Thymol	1 part
Chloroform	8 parts

AGENTS FOR REDUCING HYPERSENSITIVE DENTINE.

1; Robinson's Remedy.

Phenol crystals	2 parts
Potassium hydrate	2 parts

Mix by trituration in a heated wedgwood mortar until a crystalline mass is obtained.

2.

Paraform	5 parts
Zinc sulphate, exsiccated	100 parts

Mix with a thin solution of gum arabic into a thick paste and put into the cavity.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

3.

Solution of formaldehyde	2 parts
Thymol	2 parts
Eugenol	2 parts

Zinc oxide, enough to make a stiff paste.

4.

Paraform	1 part
Gutta-percha base plate	5 parts

Work into a mass by the aid of heat.

5.

Silver nitrate	1 part
Gutta-percha base plate	2 parts
Zinc oxide	10 parts

6.

Zinc chloride	2 parts

Absolute alcohol, enough to make a solution.

7.

Orthoform	2 parts

Eugenol, enough to make a paste.

8; Silver Nitrate Reducing Solution; Shanasy.

1.

Saturated solution of silver nitrate	1 part

Asbestos felt, a convenient quantity.

Saturate the asbestos felt with the silver nitrate solution, dry, and keep in a dark bottle.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Saturated solution of sodium hydroxide	50 parts
Phenol liquid	50 parts
Formaldehyde solution	25 parts

Keep in a well-stoppered bottle.

Dip the prepared silver nitrate asbestos into the solution and apply to the tooth.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER VIII.

AN INDEX TO ORAL DISEASES—THEIR ETIOLOGY, DIAGNOSIS AND TREATMENT; INCLUDING ACCIDENTS OF GENERAL AND LOCAL ANESTHESIA AND ACUTE POISONING. SALIVA—AND URINE ANALYSIS.

ABRASION: The mechanical wearing away of tooth substance, resulting from occlusal attrition or other mechanical causes (clay pipe stem); usually not painful, unless the pulp is irritated. Therapeutical applications are of no avail. Filling or capping of the teeth give best results. As a prophylactic measure, the clay pipe smoker should cover the pipe stem with rubber tubing.

ABSCESS, Acute Alveolar.

Causes: Gangrene of the tooth pulp and infection of the pericementum.

Symptoms: Swelling, severe pain, fever. The pus burrows along the line of least resistance and after the bone and gum tissues are penetrated, a fistula results. In the lower jaw, the pus may sink into deeper structures and perforation of the cheek, along the lower border of the jaw, or about the neck may result. Abscesses about the third lower molars are prone to produce severe complications.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Treatment: In the early stages, drainage through the pulp canal may be possible. If fluctuation is present, a deep incision is essential or the abscess may be opened with a tubular knife. If the tooth has to be removed, it should be done at once, although, in protracted cases, swelling may increase even after the tooth has been removed. Hot poultices in the form of cut figs, steeped in hot boric acid solutions, helps to bring the abscess to a focus. To establish free drainage is important. The fever is reduced with antipyretics and the engorgement of the system is relieved by saline laxatives. Severe pain is best combated with morphine. The septic root canals require proper treatment as outlined under: Pulpitis (Gangrene).

℞

Magnesii sulphatis .....℥j
Acid. sulphur. dil. .....gtt. xx
Syr. limonis .....fl ℥j
Aquae .....q. s. ad fl. ℥ iv.
M.

Sig: A tablespoonful in a glassful of water every 3 hours.

℞

Morph. sulphatis .....gr. j
M. f. pil. No. iv.

Sig: One pill every 2 hours until pain is relieved.

℞

Phenacetini .....℥ ss.
M. f. plv. No. vi.

Sig: One powder every three hours.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ACTINOMYCOSIS: Known in cattle as "wooden tongue" or "lumpy jaw." A chronic, infectious disease of cattle, sometimes transmitted to men, caused by *actinomyces bovis*, the ray fungus, a parasitic bacterium. It may involve the jaws (especially the lower), the tongue, the neck, etc. The fungus usually enters through objects which have come in contact with diseased cattle or directly with vegetable particles upon which it grows. Carious teeth or wounds about the mouth are favorable ports of entry.

Symptoms: Board-like, slow swelling of the affected parts, occasionally accompanied by severe pain in the affected region, periosteal inflammation and formation of abscesses.

Diagonosis: Only positive by means of the microscope.

Treatment: Surgical; free excision of foci. The internal administration of potassium iodide in large quantities (10 to 15 grains in milk, three times daily) is recommended. Dr. Bevan, of Chicago, reports excellent results in six cases from the internal administration of copper sulphate, ¼-½grain, three times daily.

APNEA: Transient cessation of breathing.
(See treatment of accidents of general anesthesia.)

ARSENICAL NECROSIS: Results from faulty application of the chemical or other accidents.

Symptoms: The gum tissues become highly inflamed and assume a raw ham color; the hard and soft tissues are destroyed with almost equal rapidity. It is not painful in

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

the early stages; as soon as the deeper structures (periosteum) are reached severe pain follows. The border of the bone feels rough to the touch, the teeth become loose, and if the necrosis spreads, sequestration takes place.

℞
Orthoform 3j
Lanolin.....℥ ss
M. f. ungt.

Sig: Spread on painful area and cover with cotton cloth.

℞
Orthoform .....3 j
Amyli.....℥ ss
M. f. pulv.

Sig: Dusting powder.

℞
Sol. hydrogen. peroxid.
Aquae menth. pip. .....aa fl ℥ ij
M.

Sig: Tablespoonful in a tumblerful of warm water as a mouth wash.

Burns are caused by the action of intense heat upon the tissue; in the mouth they are rarely worse than the first degree. They require little more than palliative treatment; i. e., ice and saturated solution of sodium bicarbonate. Quite frequently, however, cauterization of the oral tissues with strong acids or alkalis occurs; the treatment

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

corresponds to the nature of the cauterant. Severe pain is relieved by dusting the corroded surfaces with mixtures of orthoform and starch, equal parts.

CAUTERANTS.	REQUIRE:
Silver nitrate	Concentrated solution of sodium chloride.
Ammonia	Lemon juice or diluted vinegar, white of eggs, demulcent drinks.
Caustic potash (lye)	Same treatment as for ammonia.
Mineral acids	Gargle with soapsuds, give chalk, raw egg, and lime water.
Phenol and Trichloracetic acid	Fifty percent alcohol as quickly as possible, followed by rinsing the mouth with cold water and the application of a mild salve.
Tincture of iodine	Sweetened water.
Formaldehyde solution	Ammonia water.
Pyrozone*	Alcohol, followed by water.

CYANOSIS: Blue discoloration of the skin resulting from insufficient oxygenation of the blood.

Treatment: Remove the cause; fresh air and horizontal position of patient and rest.

CYSTS: Slowly growing benign tumors containing serous, mucous, hemorrhagic or other fluids. They may be divided into follicular cysts, dermoid cysts and retention cysts. Follicular cysts, resulting from abnormal enlargement of pre-existing cavities, frequently contain remnants

**Caution:* If pyrozone is spilled upon woolen fabrics, i. e., the dress of the patient, its rapid oxidation may set fire to the cloth.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

of the enamel organ in the form of imperfectly developed teeth (odontomes) and are spoken of as dentigerous cysts. Dermoid cysts are formed from remnants of epithelial cells; they are rarely found in the oral cavity. About the roots of teeth frequently fungous growths are formed which are referred to as dental cysts; they may result from disturbances during detention or from other causes. Retention cysts are formed through the enclosure of a gland duct, either by some remaining epithelial cells or through an obstruction of the duct from other sources. An important cyst of the mouth is ranula, a retention cyst of the sublingual glands.

Treatment: Dentigerous cysts are referred to the surgeon, ranula may be destroyed by cauterants or it is surgically removed. A stout silk thread is drawn through the cyst and tied over the outer wall (seton). In from 10 to 15 days the inner cyst walls may unite. Extirpation of a part of the cyst wall or of the entire gland may be necessary. Truman W. Brophy employs a metal seton made of a "small silver tube and perforating it with holes; then, bending it so as to form a ring about one-half inch in diameter. This is an open ring, one end of which is carried into the cyst and out through the mucous membrane and telescoped into the other end, thus uniting the ends of the two and completing the ring. The perforated ring thus introduced will admit the saliva within the cyst and allow it to escape through the tube into the mouth. The ring must be rotated daily, else the tissues may fill the openings in it, thus defeating the object of this insertion. The tissues around the ring will become smooth and a few weeks only will suffice to establish permanent openings, after which the ring may be removed and the saliva

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

will escape through the openings so perfectly formed around the silver tube."

DENTAL CARIES: It is a chemico-parasitic process, consisting of two definite stages—decalcification of the tooth substances and the destruction of the remaining organic matrix. The second stage is not to be clearly observed in the decalcification of the enamel (Miller). As predisposing factors are to be mentioned: purely calcified teeth, irregularities of form and position, unhygienic surroundings, constitutional disturbances, the condition of food stuffs, etc.

Treatment: As prophylactic measures, suitable food materials rich in lime and phosphorus, proper exercise of the jaws, and proper hygiene of the mouth, are indicated. In the early stages of caries, the application of silver nitrate under suitable conditions will inhibit the progress of the disease. The proper treatment of the carious defects consists in the thorough removal of all carious material, and in filling and restoring the normal outline of the tooth. (For mouth and tooth preparations see Chapter VI.)

DENTAL HEMORRHAGE: Results from tearing the blood vessels of the periosteum during the extraction of teeth. Occasionally profuse hemorrhage occurs from tearing large arteries in extracting lower molars (inferior dental artery). Four cases are on record where the artery bodily passed through the roots of these molars. Organic disturbances, i. e., hemophilia, chlorosis, enemia, leukemia, etc., are often responsible for persistent dental hemorrhage. Vicarious hemorrhage of the gum tissue may occur during menstruation.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Treatment: Normal dental hemorrhage resulting from the extraction of teeth, etc., requires little attention; in severe cases plugging and splinting of the sockets is always successful. Introduce softened modeling compound into the mouth, let the patient close the jaws, press about the teeth, remove, chill and trim. Wash away the blood clot, and tightly pack into each single alveolus a narrow strip of iodoform gauze, having the tip of the gauze moistened with a paste made of powdered stypticin or styptol and water. Have the plug slightly extending above the border of the alveolus. Replace the prepared splint and apply a Bardon bandage (figure of 8.) The plug and the splint may remain several days. Internally administer stypticin or styptol tablets; to reduce blood pressure give five grains of phenacetin. Let patient assume a sitting posture; keep him from all excitement and order liquid diet. No alcoholics should be allowed. If hemorrhage occurs from torn gum tissues apply gauze strips dipped in a warmed solution of stypol (20%). Severe interpapillary hemorrhage is checked by applying a 25% solution of chromic acid. Occasionally parenchymatous hemorrhage occurs in patients wearing full dentures. It is usually due to ill-fitting plates, uncleanliness, etc. Cleanse the plate thoroughly, cover with thin gauze strips dipped in 20% styptol solution and reinsert the plate. Remedy the defects of the denture.

R.
Styptol tablets (sugar coated)....gr. ¾
No. xv.

Sig.: Two tablets, three to four times daily.

Dental Pharyngitis: Dental angina. Catarrhal in-

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

flammation of the upper pharynx from dental causes; usually resulting from difficult eruption of a third lower molar or as a sequence of stomatitis and other mouth infections.

Symptoms: Difficult and painful deglutition, a typical red ring about the pillars of the fauces and infection of the tonsils.

Treatment: Saline aperients, prohibition of tobacco, alcohol and highly spiced food. Gargling with antiseptic and astringent solutions, and, in severe cases, silver nitrate or iodine application.

℞

Tinct. ferri. chloridi .....fl. ℥ iij
Glycerin .....fl. ℥ j
Aquæ .....q. s. ad. fl. ℥ ij
M.

Sig.: A tablespoonful in half a glass of warm water as a gargle.

℞

Iodini .....gr. v
Pot. iodini .....℥ ss
Glycerini .....fl. ℥ ss
M.

Sig: Apply on a swab.

DENTITION: It is a physiological process which, normally, is not accompanied by any disturbances. The so-called diseases of dentition, i.e., diarrhœa, dysentery, fevers, etc., result, in the majority of instances, from improper feeding during the period of most active development

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

of the child. If the teeth erupt too early, extraction is not indicated unless some faults in their development make it necessary. The removal of such teeth is usually accompanied by severe hemorrhage. The eruption of the teeth may, by reflex irritation from pressure upon the overlying gum tissue, cause discomfort to the child. It is readily relieved by proper scarification. A deep cut is made over the advancing tooth, i. e., crucial incisions over the molars, and singly over the cutting edges of the anterior teeth. General disturbances are to be treated according to symptoms.

The eruption of the third molars frequently causes severe disturbances on account of lack of space and malposition. These disturbances are traumatic in their nature, and should be treated accordingly. If the tooth is to be removed, general anesthesia is usually indicated; the accompanying trismus and infiltration of the tissues prevent the successful injection of a local anesthetic. Lecluse's elevator is of excellent service if the tooth cannot be reached with the ordinary or a Physick's forceps. The gum tissue overlying the tooth is to be divided before the extraction is made. If the socket is infected and painful, packing with iodoform gauze dipped in orthoform and strict antisepsis are important. Dry, hot applications applied externally are of service. The swelling about the angle of the jaw and the lymph glands is benefited by iodine (colorless) application, and by passive massage. Sore throat (see: Dental Angina) very frequently accompanies the eruption of this tooth. In the early stages, small chips of ice held in the mouth, together with the removal of the overlying gum tissue, and antiseptic washes will often result in a speedy recovery.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

℞

Iodipini, 10%.

Sig.: Paint upon the inflamed surface and cover with a cloth.

Dislocation of the Mandible: It may be unilateral or bilateral; more prone in women than in men. One or both condyles have slipped out of the glenoid cavity and rest upon the inter-articular fibrocartilage directly over the articular eminences. The jaw is usually rigid, the mouth wide open; chewing and speaking is much impaired.

Treatment: Place patient in a low chair, the operator wraps his thumbs with cotton or with napkins to protect them against injury. He stands in front of the patient, having the head fixed by an assistant or on the head rest of the chair and then places the thumbs firmly upon the jaw in the region of the lower molars while the other fingers rest on the body of the jaw near the symphisis. Pressure is now made downward with the thumbs and forward and upward with the fingers, and when the condyles have passed the articulating eminence they will snap back into the glenoid fossæ. A metal rod (excavator) covered with cotton and placed crosswise over the teeth in the bicuspid region acts as a fulcrum when backward and upward pressure is brought upon the symphisis and it may be used for this purpose. The patient should be instructed to be careful in not opening the mouth too far. A chin bandage may be worn for a few days.

Dry Mouth (Xerostomia): Pathological dryness of the mucous membrane of the mouth resulting from impaired secretions of saliva.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Causes: Severe psychical and physical disturbances, nervous diseases, diseases of the digestive tract and other unknown factors. The diseased salivary glands (mumps) may secrete a much lessened amount of saliva at times.

Symptoms: Painful deglutition and speech. The mucosa is dry, shiny, and stretched; the tongue is bright red, cracked and dry. No inflammation. The disease may last for years.

Treatment: Pilocarpine hydrochloride internally; if resulant from nervous diseases, electricity is indicated. While recovery is very problematical, the patient may be made comfortable by continuous use of the above drug.

℞

Pilocarpin. hydrochlorid .....gr. v
Aquæ distillatæ .....fl. ℥ ss
M.

Sig.: Five drops three times daily.

Slowly increase the dose by one drop until from 8 to 10 drops per dose are taken.

Dyspnea: Labored breathing; suspended animation from a deficiency of oxygen in the blood. May also result from inhaling an anesthetic or poisonous gases; i. e., coal gas, water gas, etc.

Treatment: Fresh air, horizontal position of patient, dashing of cold water in the face and artificial respiration. (See: Treatment of accidents of general anesthesia.)

Emphysema of the Cheek: The inflation of the interstices of the connective tissues with air. It may result from

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

air penetrating into the tissues after tooth extraction or from careless injection of solution of hydrogen peroxide into a closed cavity, setting free nascent oxygen.

No treatment necessary, as swelling will subside spontaneously. A tight bandaging is often of some benefit.

EMPYEMA OF THE MAXILLARY SINUS (antrum of Highmore): An accumulation of fluid in the maxillary sinus; either acute or chronic. It may be caused by infectious diseases (influenza), diseases of the teeth, traumatism, etc. Tumors, polypi and other foreign bodies are often responsible.

Symptoms: More or less dull pain in the affected side of the face; foul smelling discharge from the nostril, especially when the head is bent forward and turned to the sound side and in blowing the nose. The disease may be unilateral or bilateral.

Diagnosis: Discharge from the nose and the general symptoms are helpful in making a diagnosis. The dull shadow picture of the diseased sinus as revealed by the rays of the electric mouth lamp is helpful but not reliable. A trial puncture and washing of the sinus with a saline solution is the only positive means of diagnosis.

Treatment: If a diseased tooth is the causative factor, the tooth is to be removed and the sinus opened through its socket, according to Cowper, provided the opening affords ready access to the sinus; or an opening is made between the apices of the roots of the first molar and the second premolar, according to Drake. The opening of the sinus through the canine fossa, according to Desault, offers the best results, as it allows a clear inspection of the entire

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

cavity. The gum tissue between the canine and the first molar is locally anesthetized, a semi-circular cut is made reaching from the canine eminence to the second bicuspid, and the tissues, including the periosteum, are lifted up. With a fine spear drill the facial wall is perforated and with suitable fissure burs sufficiently enlarged to allow the little finger to enter. Foreign bodies or granulations are removed with the curette. The sinus is washed with at least a quart of warm saline or Thiersch's solution and tightly packed for twenty-four hours with iodoform gauze. The further treatment consists in irrigating the sinus with mild antiseptic solutions. Solid plugs made of gutta percha, vulcanized rubber, or metal should now be used to keep the sinus open. They are reduced in size with the progress of recovery. In extreme persistent cases, a large part of the facial wall is removed, and a "window" is made leading into the middle meadus of the nose; the whole sinus is thoroughly curetted and cauterized. Chronic cases may require treatment for a year or two.

℞
Sodii chloridi .....ʒ ss.
Aquæ .....fl. ʒL
M.
Sig.: Use as a douche.

℞
Acidi salicylic .....ʒ j
Acidi borici .....ʒ iv
Aquæ.....fl. ʒ xxxij
M.
Sig.: Thiersch's solution.

Exostosis: See Hypercementosis

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

FRACTURE OF THE ALVEOLUS: Resulting from difficult or clumsy extraction or other traumatic causes.

Treatment: Remove loose pieces and smoothen sharp edges of the bone with a fissure bur or carborundum stone. If the teeth are loose, they are tied with silk ligatures. If the alveolar process is broken, replace it, if possible, and if the teeth are present, ligate them to sound neighbors. Paint with tincture of iodine and advise ice to be held in the mouth to reduce inflammation. Astringent mouth washes are indicated.

R.
Acid. benzoic. .....℥ j
Tinct. krameriæ .....fl. ℥ ss
Aquæ hamamelidis. ....q. s. ad. fl. ℥ iv
M.

Sig.: Tablespoonful in a glassful of warm water as a gargle.

FRACTURES OF THE JAWS: Upper Jaw.—It is comparatively rare; it is frequently accompanied by crushing of the maxillary sinus (antrum of Highmore) and fracture of the other bones of the face and skull.

Treatment: Replace fragments by manipulating through the mouth and nose. In vertical fractures, an interdental splint is indicated. (Gunning's or Kingley's splint with the necessary modification.) Feed the patient on liquid diet. Union takes place in from three to five weeks.

Lower Jaw.—The fractures are recognized by mobility, crepitus, and dropping of the mouth on the side of the face.

Treatment: If teeth are present simply lash the lower

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

jaw firmly to the upper by Gilmer's wire ligatures (No. 28 German silver or brass wire) or by means of Angle's or Lukens fracture bands applied on both sides of the fracture. Look after correct articulation. In complicated cases, an interdental splint with or without external steel hooks or a Gunning splint is indicated; wiring of the fragments is sometimes necessary. A suitable splint may be quickly constructed over the articulated models from a good, hard modeling compound; it can be kept in the mouth for a month without deterioration. A chin boot made of metal, vulcanite or gutta percha is occasionally helpful. In edentulous jaws an interdental splint is essential. A Barton or Black bandage is of advantage. Union will take place in from three to five weeks. Antiseptic mouth washes are indicated. Feed the patient on liquid diet with a hooked glass tube (short bent saliva ejector) around the molars.

℞

Resorcinol.....ʒ j
Zinc. chlorid.....gr. x
Menthol.....gr. xx
Thymol.....gr. xv
Glycerin.....fl. ʒ j
Alcohol.....fl. ʒ ij
Aquæ hydrogenii dioxidi q. s. ad. fl. ʒ viij
M.

Sig.: Teaspoonful in half a tumblerful of warm water as a mouth wash.

Fracture of the Teeth: If the crown is fractured, replace it by an artificial substitute; if the root is fractured,

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

an attempt may be made, in favorable cases, to save it by banding. Callous union may occur if the pulp recovers.

GINGIVITIS, acute or chronic: An inflammation of the gum tissue.

Symptoms: More or less severe inflammation of the gums brought about by local irritation; ill-fitting dentures are frequently the cause. The gums are turgid, loosened from the teeth, and upon slight irritation they bleed profusely.

Treatment: Thorough removal of all deposits from the teeth and especially from beneath the free edge of the gum margin; and thorough polishing of the tooth surfaces. The inflamed edge of the gum is touched with a 10 per cent solution of trichloracetic acid or with powdered copper sulphate made into a paste with water.

℞

Cupri sulphatis .....ʒ j
Acidi lactici .....fl. ʒ ss
M.

Sig.: Apply with a platinum loop about the free edge of the gums.

℞

Acidi borici .....ʒ iij
Zinci chloridi .....gr. x
Aquæ hydrogenii dioxidi .....fl. ʒ ij
Aquæ menth. piper .....q. s. ad. fl. ʒ viij
M.

Sig.: A teaspoonful in half a glassful of hot water as a mouth wash.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Gingivitis Nudata (Arkoevy): Acute ulcerous gingivitis (Gilmer). A comparatively rare disease; its onset is sudden. It is confined to localized areas, seldom involving the entire gum tissue. "The lingual margins and festoons of the gums do not participate at first in the inflammatory process, but later the festoons are destroyed and deep pockets are formed in the interproximal spaces. The parts attacked present the appearance of having been gnawed away until most of the gum tissue overlying the alveolar process immediately adjoining the teeth has been destroyed. The breath of the patient is fetid, the saliva ropy, and in excess of the normal" (Gilmer). The disease may last for weeks and months.

Treatment: Irritating food stuffs are to be avoided. Bland and slimy drinks, such as rice water, oatmeal infusion, etc., are advised, and mild antiseptic mouth washes, but no astringents, are indicated.

Hypertrophy of the Gingivæ: A pathological growth of gum tissue resulting from chronic irritation brought about by ill-fitting crowns, calcareous deposits, and neglected mouth hygiene. The hypertrophic growth may be of a fibromatous nature.

Treatment: Simpler cases yield readily to local treatment; remove the cause and thoroughly clean the mouth and the teeth and apply cauterants, i. e., properly diluted solutions of chromic or trichloracetic acids. Larger areas of hypertrophied tissues are removed with the knife. In severe cases, major surgical interference is necessary.

Hypercementosis: A circumscribed increase of the

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

volume of the cementum of a tooth; diffuse growth is sometimes referred to as hypertrophy of the cementum.

Causes: Irritation from projecting root fillings, crown fillings, ill-fitting bands, or other chronic irritation of the pericementum. Pyorrhœa alveolaris, syphilis, metal poisoning (mercury), or the loss of the opposing tooth are claimed to be causative factors.

Symptoms: Usually not present. Gnawing and neuralgic pain are met with.

Diagnosis: Difficult. The skiagraphic picture of the suspected tooth may be of value.

Treatment: In suitable cases amputation of the root is advisable, otherwise extraction, which, however, is often very difficult and usually accompanied with considerable bruising and damaging of the alveolar bone.

Lock-Jaw: Trismus, either tonic or clonic spasms of the muscles of mastication. Tonic spasms may result from difficult eruption of the lower third molars, faulty extraction, abscesses, or periosteal inflammations and severe infections (actinomycosis).

Treatment: According to the causes. Inflammatory processes in the early stages may be abated by ice, or sometimes by dry heat applied externally (hot water bag). Abscesses should be at once opened and hot, wet fomentations applied externally. Clonic spasms do not require treatment. In true ankylosis, separation of the ankylosed joint by an operation is the only relief.

Luxation of Teeth: Resulting from traumatic causes.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Treatment: In complete luxation replace the teeth and tie with silk ligature to the neighbors. Apply Talbot's glycerol of iodine to allay periosteal disturbances. Test for pulp reaction with heat, the mouth lamp, and a weak electric current. If the tooth is completely detached from its socket, replantation is advisable. Pack the cleansed alveolus tightly with iodoform gauze. Remove the pulp, fill the canal aseptically, cut off about 1/8 inch of the apex and sterilize the tooth in mercuric chloride solution 1:1000. If the peridental membrane of the tooth is intact, keep the tooth in physiological salt solution, warmed to body temperature, until ready for replantation. Replace and tie with silk ligature or hold the tooth in position with a metal splint. Antisepsis of the mouth is essential.

Leucoplakia (Leucoplakia oris, psoriasis linguæ, ichthyosis buccalis, smoker's patch):

Etiology: Not settled; constant chewing, or smoking, highly seasoned food, rough edges of teeth, predisposition of the tongue and the mucous lining of the mouth, or as a result of a former attack of syphilis. Rarely seen below thirty years of age; scarce in women.

Symptoms: Circumscribed or diffused white or blue-white patches; smooth, cornified or roughened. The epithelium is much thickened. It is usually not painful; in some cases increased flow of saliva, in others dry mouth.

Diagnosis: Differentiation from syphilitic plaques: Its bluish white color, no ulcerations and its history. If as a result of syphilis, the latter is to be regarded as the primary disease.

Treatment: In general, leucoplakia may be harmless;

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

however, it is occasionally the starting point of cancer. Bring the mouth in a hygienic condition; alkaline mouth washes with a decoction of huckleberries are indicated. Paint the affected parts with balsam of Peru and cauterize, in the early stages only, with chromic acid or lactic acid. Hydrogen peroxide solution (10%) for cleansing the plaques is useful. Papain solution for the digestion of the plaques is recommended. Prolonged cauterizing is harmful. In general, medicinal treatment is of little benefit. Surgical removal of the plaques by means of the curette or the Paquelin cautery is indicated, if the plaques spread.

℞

Acid. chromic .....ʒ ij
Aquæ destillatæ .....q. s. ad. fl. ʒ iv
M.

Sig.: Paint with a cotton-wrapped tootpick on the affected surface.

℞

Fruct. myrtil.....ʒ ij
Sod. bicarbonat. .....ʒ ij
Aquæ fervitæ .....q. s. ad. fl. ʒ xvj
F. Decoct.

Sig.: Undiluted to be used as a mouth wash.

℞

Papaini .....gr. v
Glycerini .....fl. ʒ j
Aquæ .....q. s. ad. fl. ʒ ij
M.

Sig.: Paint upon the affected surface.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Mouth Wash Eczema: A peculiar eczematous eruption about the external mouth caused by the constant irritation from the use of mouth washes containing large quantities of essential oils, menthol, salol, etc.

Symptoms: Scaly eruptions about the lips and chin but more especially at the corners of the mouth. Those suffering from seborrhœa and eczema show predisposition.

Treatment: Prohibition of the mouth wash, substituting warm salt water as a test solution. Externally apply zinc ointment or cold cream.

Necrosis of the Alveolar Process: It may result from faulty arsenic application (which see), phosphorous poisoning (which see), pulp gangrene, abscesses, etc.

Symptoms: It usually starts with a simple periositis; later the formation of abscesses and fistulas occurs. The periosteum is destroyed and the bone feels rough to the touch. Sequestration of the dead bone takes place in due time.

Treatment: If the necrosis is the result of traumatism, the removal of the loose bone spicula and antiseptic treatment of the wound will usually bring about a speedy recovery. If a large part of the bone is involved, no interference should be made until sequestration takes place. Free evacuation of pus is essential. If a part of the jaw is removed prosthetic appliances are usually necessary to preserve the contour of the face. Strong deodorizing and antiseptic solutions are essential.

℞

Pot. permanganat. .....3 ij

Sig.: A few crystals in a glassful of warm water as a mouth wash.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

℞

Zinc chlorid. .....gr. v
Aquæ hydrogen. dioxid.
Aquæ menth. pip. ..aa q. s. ad. fl. ℥ iv
M.

Sig.: A teaspoonful in half a glassful of warm water as a mouth wash.

NEURALGIA, tri-facial: Tic douloureux; Fothergill's disease; prosopalgia.

A disturbance of the fifth pair of nerves, manifesting itself in a sharp and darting pain, usually unilateral.

Symptoms: The pain is paroxysmal, mostly along the points of the nerve branches. It may be located in the upper or lower jaw, especially near the supra- and the infra-orbital foramen and near the mental foramen Convulsive twitching of the muscles along the course of the nerve is observed. Disturbances of nutrition, anemia, chlorosis, anomalies of menstruation are often responsible. Neuralgia of the teeth proper is comparatively rare. It may be caused by hypercementosis, impacted teeth, tumors, empyema of the maxillary sinus, reflex disturbances, chronic constipation, etc.

Treatment: If possible, remove the cause. Careful examination of the teeth for hidden cavities should be made. In obscure cases, the X-ray may be of service. If not of dental origin, it should be referred to the physician.

℞

Ungt. veratrinæ .....℥ ss

Sig.: Rub a small quantity over the painful surface and cover with cotton cloth.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

℞

Chloroformi.
Alcoholis .....aa fl. ℥ j
Tinct. aconiti .....fl. ℥ ij
Olei menth. pip.....fl. ℥ iij
M.

Sig.: Externally. Apply on cotton upon the painful surface.

℞

Aspirini .....℥ i
F. plv. No. vi.

Sig.: One powder every three hours.

℞

Tinct. gelsemii .....fl. ℥ ss

Sig.: Eight drops three times a day.

Ostitis and Osteomyelitis: Inflammation of the jaw bone. It may be idiopathic; resultant from traumatism; a concomitant expression of a general disease, or an intoxication. Diseased teeth, fracture of the jaw, syphilis, scurvy, mercury and phosphorus poisoning, and a peculiar infection of the periosteum of the jaw bones in workers of mother-of-pearl are causative factors.

Symptoms: Very painful swelling of the periosteum; the lymph glands are affected and the teeth are loosened.

Treatment: Poultices are frequently necessary to soften the swelling; if pus is present, an incision is made and the periosteal surfaces are curetted. The wound is washed with antiseptics and cauterized with 8% solution

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

of zinc chloride and packed with gauze. Antiseptic mouth washes are important.

℞

Zinc. Chlorid. .....gr. xl
Aquæ .....fl. ℥ j
M.

Sig.: To be used as a swab.

PERICEMENTITIS: Inflammation of the pericementum. Clinically, three stages may be observed: Acute, purulent, and chronic pericementitis. Causative factors are: Trauma, too high fillings, rapid separation, faulty root canal fillings, foreign bodies between the teeth, calcareous deposits, metal poisoning (arsenic, phosphorous, mercury), bacterial infection starting from the apex or the gingival border, etc. As secondary factors may be counted: Sequences of general disturbances (gout, rheumatism, syphilis).

Symptoms: The tooth feels elongated on account of the swelling of the pericementum. The gum tissue is inflamed and the swelling may become edematous, involving the whole side of the face. The pain is very severe; it slightly subsides with the formation of the edema.

"Many practitioners have no clear conception of the difference between pericementitis and pulpitis, inasmuch as each produces a distinct odontalgia or toothache which only close observation will distinguish from the other. And yet the two conditions have little in common except the pain, and that is not of the same character. It may be well to compare their pronounced symptoms as an aid in diagnosis.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

PULPITIS.

The pain is of a sharp, lancinating character, and in its earlier stages it is distinctly paroxysmal.

The tooth is exquisitely sensitive to thermal changes; in its inceptive state cold, and in its later condition heat, exacerbating the pain.

There is no swelling of the tissue about the tooth, and no tenderness to pressure in ordinary cases, unless the pulp shall in some way be exposed.

At times it is quite difficult to determine exactly which tooth is affected, the pain being fleeting in its nature, and inducing reflex symptoms in other teeth and tissues.

The pain is apt to be worse upon going to bed, and excitement and fatigue increase it.

It is possible to bite upon the tooth without any special sensation, and to use it in mastication, if thermal extremes be avoided.

PERICEMENTITIS.

The pain is dull, steady, boring, throbbing in its character, and is not at all paroxysmal.

There is no sensation to changes of temperature, and neither cold nor hot applications materially affect it.

The tooth becomes exceedingly sore, and the least pressure upon it causes pain. In the latter stage swelling is common.

There is no trouble in deciding which tooth is the diseased one, the pain being steady in degree and in position, and the soreness readily locating it.

The pain remains nearly constant without much reference to external conditions or circumstances.

The tooth is very sore to the touch, and occlusion in mastication or ordinary shutting of the mouth giving pain, irrespective of thermal changes.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

The tooth is not elongated, nor does it strike first in occlusion.	The tooth is raised in its socket, and strikes before any of the others occlude. (BARRETT.)

Treatment: Removal of the cause is of prime importance. If the disturbances result from mechanical causes they usually yield readily to treatment after the causative factors have been eliminated. Painting of the affected surfaces with an iodine solution (Talbot's iodo-glycerol) as a palliative measure is of some service. If the disturbances are of chemical origin, i. e.: arsenic, phosphorous, etc., they are treated as outlined under their respective headings.

The disturbances about the apex of a tooth require prompt removal of the accumulated putrid masses from the root canals. The latter are to be opened to allow free drainage. The avoid unnecessary severe pain, stability of the tooth is essential (traction is made with a string; plaster of Paris or modeling compound splints); scarification of the highly inflamed gum tissues is of benefit, while in the early stages ice chips held between the gum and the cheek are helpful in reducing inflammation.

If pus collects about the apex and no ready drainage is obtained, very intense pain is the direct sequence. An endeavor should be made to drain the pus through the root canal (blind abscess). If this is not possible, an opening is made through the gum tissue and the bone with a fissure bur or a small tubular knife, and an artificial fistula established. If the disturbance is left alone, nature helps herself; the pus may burrow through the bone and gum tissue along the line of least resistance, or along the pericementum toward the gingival line. As soon as free drainage is obtained the

---

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

pain is much mitigated; it may often stop completely. (See: Acute Alceolar Abscess.) With the successful treatment of the infected root canals and proper filling, the fistula will close in due time and the pericemental disturbances disappear. If, on the other hand, a diffuse pus infiltration of the entire pericementum results, recovery is not to be expected; the tooth has to be removed. Occasionally we find teeth, usually multi-rooted teeth, where the root fillings have not been successfully placed, remnants of putrid matter are left about the apices and, as a sequence, the pericementum is kept in a chronic state of inflammation. Such teeth are a continuous source of trouble. The slightest disturbance (cold, influenza, menal or physical strain) may set up a renewed severe acute inflammation with all its sequences It is then best to remove the root filling, treat the canals antiseptically and again restore the filling. Resection (amputation) of the root is the most promising procedure.

℞

Tricresol .....fl. ʒ ij
Formalini .....fl. ʒ j
M.

Sig.: Mechanically evacuate the pus and, on cotton, hermetically seal in the canals from 24 to 48 hours, two or three times—oftentimes one treatment is sufficient. (J. P. Buckley.)

℞

Phenol. cryst.
Thymolis .....aa ʒ ij
Camphoræ .....ʒ j
M.

Sig.: Seal into root canal.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

℞

Zinci iodidi .....ʒ j
Iodi .....ʒ v
Glycerini .....fl. ʒ i
Aquæ .....q. s. ad. fl. ʒ iv
M.

Sig.: Paint upon the gum surfaces of the affected tooth.

℞

Tinct. aconiti.
Tinct. iodi.....aa fl. ʒij
Chloroformi .....fl. ʒ j
M.

Sig.: Paint upon the gum surfaces of the affected tooth.

℞

Morphinæ sulphatis .....gr. j
M. f. pil. No. iv.

Sig.: One pill every two hours until relieved.

℞

Tablet aspirini .....gr. v
No. vi.

Sig.: One tablet every two hours with a tumblerful of water.

℞

Magnes. sulphatis.....ʒ j
Acid. sulphur. dil.....fl. ʒ ss
Syr. limonis.....fl. ʒ j
Aquæ .....q s. ad. fl. ʒ iv
M.

Sig.: A tablespoonful in half a glassful of water every three hours until free movement of the bowels is established.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Phosphorus Necrosis: This disease is rare at present on account of improved hygienic conditions in match and chemical factories. Rigid prophylaxis is the best preventative.

Symptoms: Intoxication is very slow, extending over months. Carious teeth are the main gates of entry of the phosphorus gases; it is primarily located in the lower jaw. Severe pain, periostitis, loosening of teeth, osteomyelitis and finally necrosis, which often involves the entire mandible, are the results.

Treatment: Resection of the involved bone along the line of demarcation; packing with iodoform gauze and rigid antiseptic. Patient must keep away from factory; nutritious food and tonics are recommended (milk, cod liver oil, beef, wine and iron).

℞

Fl. extr. cascara sagrada.....fl. ℥ j
Liquor ferri pepto-mangan., q.s.ad.fl. ℥ xij
M.

Sig.: Tablespoonful three times daily, an hour after meals.

Pulpitis: Inflammation of the pulp.

1. Hyperemia. The pulp is hypersensitive; heat and cold produces short acute, but very pronounced expression of pain.

Causes: Irritation brought about by chemical, physical or mechanical agencies, i. e.: through a carious defect or through the exposure of a tooth root. Heat, resulting from

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

the too rapid rotating of a disc in finishing a filling frequently produces a prolonged hyperemia.

Treatment: If the insults result from the sequences of a carious defect, the cavity should be excavated; present acids of fermentation are neutralized by washing with warm alkaline solutions; antiseptics, i. e.: phenol, thymol, eugenol, with astringents in the form of tannic acid are applied and a temporary filling is inserted. If hyperemia results from an exposed root, the application of silver nitrate in the form of a concentrated solution or in substance upon the surface of the root gives temporary relief.

℞
Orthoformi .....gr. v
Glycerit. acidi tannic q. s. to make a paste.
M.
Sig.: Seal into the cavity for 48 hours.

2. Acute pulpitis, partial and total. If the pain of the pulp is persistent, i. e.: from several hours to several days, a more or less severe inflammation of the pulp is present; a minute exposure may frequently be located upon close examination.

Treatment: In the teeth of the young an effort should be made in the early stages of the inflammation to preserve the pulp by palliative treatment. Astringents and antiseptics are applied and the bottom of the cavity is lined with a non-conductive material, i. e.: asbestos felt. The temporary filling must remain from one to six months. In the adult it is usually better practice to destroy the pulp at once and replace it by an aseptic root filling.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

(For root filling materials and arsenical compounds for devitalizing purposes see: Pharmaceutical Compounds, Chapter 7.)

3. Purulent pulpitis, partial and total.

Diagnosis: Diffuse continued more or less severe pain upon the side of the face where the tooth is situated. Pain usually increases upon assuming a recumbent position. This form of pulpitis frequently results from cement and other fillings placed into too close proximity to the pulp.

Treatment: Palliative treatment for 48 hours before the arsenical compound is applied to prevent violent pain, which will always result when arsenic is applied to an inflamed pulp. Mixtures of cocain, eugenol, thymol, phenol, etc., are sealed into the tooth as indicated. If possible the pulp is relieved of blood and pus by pricking it with a sterile smooth broach. After it is divitalized it is removed and an aseptic root filling substituted. It is often a physical impossibility to remove all of the pulp tissue from certain root canals; the mummifying principle applied in such cases is then indicated.

4. Necrosis and Gangrene of the Pulp. If the canals are still closed the preliminary treatment consists in opening the pulp chamber sufficiently to allow the free escape of gases; no attempt is made at this time to enter the root canals. Small, loosely rolled pledgets of cotton saturated with a bland antiseptic are placed in the tooth and the patient dismissed for twenty-four hours. On the return of the patient the canals are opened and as much as possible of their contents removed. Strong antiseptics, i. e.: a mixture of formaldehyde solution and cresol, monochlorphenol, etc., may now be sealed into the canal. If the canals are obstructed, sulphuric acid (50%) followed by

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

sodium dioxide is pumped into the canals to gain entrance by dissolving the calcarious deposits. After thorough disinfection the canals are aseptically filled. (For antiseptic compounds and root filling materials used in this connection see: Pharmaceutical Compounds, Chapter 7.)

Pyorrhoea Alveolaris: A chronic destruction inflammation of the pericementum with a more or less severe inflammation of the gingivæ and necrosis of the alveolar bone in the region of the affected tooth. (Miller.)

Causes: *Local:* Salivary and serumnal calculus, chronic irritation from ill-fitting dentures, distorted articulation, orthodontia appliances and other sources. *General:* Gout, rheumatism, diabetes mellitus, locomotor ataxia, and other constitutional diseases. Metal poisoning and probably predisposition.

Symptoms: The disease begins with a slight loosening of the affected tooth, gingivitis and subsequent formation of a pocket. Pus is not always present in the early stages; later it may be dislodged by pressure upon the pocket. The gingivæ become detached from the tooth and necrosis of the alveolus follows: There is little fetor from the mouth; the disease usually produces little inconvenience to the patient in the earlier stages.

Treatment: The removal of all deposits from the roots with suitable instruments is of prime importance. The pockets are washed out with hot antiseptic solutions and cauterized. Trichloracetic acid, 10—25%, aromatic sulphuric acid, a saturated solution of copper sulphate in hot lactic acid, etc., are to be recommended. Loose teeth are

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

ligated to their sound neighbors or held in permanent position by fixed metal splints. Articulation is restored and the mouth is brought in a hygienic condition. The gums are saturated with a concentrated zinc iodide solution and frequently massaged. The continuous use of astringent and antiseptic mouth washes are highly indicated.

Uric acid diathesis is held to be the sole cause of pyorrhoea alveolaris by some writers. The copious drinking of water, especially weak alkaline water (lithia) together with a well-regulated diet and proper hygienic measures will be of marked benefit. A suitable uric acid free diet may be easily selected from the following dietary:

Dietary.

ALLOWED:	PROHIBITED:
Water, especially weak alkaline mineral water.	All raw meats (beef, mutton and pork).
Very weak tea.	All glandular tissues (kidney, liver and sweetbreads).
White meat of chicken, turkey, quail.	Asparagus, celery, radishes.
Meat soups in small quantities only.	Beans and peas.
All cereals, rice and breakfast foods.	Coffee.
All green vegetables.	All liquors, wines and spirits.
Cabbage in moderation.	Pastry and confections.
Dried fruits and nuts.	Sharp sauces and mayonnaise.
All breads.	
Eggs in moderation.	Mushrooms.
Milk.	

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

As a solvent of the uratic tophi hexamethylene, also known as urotropine, formine, saliformine and cystogen, is recommended. If the underlying cause is a general disease, the co-operation of the family physician should be secured.

℞
Lithii citratis.....gr. v
Tablet, No. L.
Sig.: One tablet dissolved in a tumblerful of water five times a day.

℞
Hexamethylenaminæ .....ʒ ss
Colchicinæ .....gr. ss
M. f. tablet No. LX.
Sig.: One tablet dissolved in a tumblerful of water five times a day.

Stomatitis, Aphthous: Primarily a disease of childhood. Small, round ulcers of a grayish color surrounded by a red, narrow border; occasionally three or four ulcers will coalesce to a larger one. It is found principally upon the surfaces of the tongue and upon the buccal mucosa. Especially prone to be present at the time of the first dentition; rarely in the adult.

Symptoms: Painful and burning mouth; slight fever. The salivary secretions are increased. Usually, in ten to fifteen days the ulcers disappear without leaving a scar.

Treatment: Perfect cleansing of the child's mouth and the utensils employed in nursing. Washing of the child's mouth with a two percent boric acid solution or with slight astringent mixtures. Use the finger, wrapped with cotton

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

cloth and dipped into the warmed solution. An eight per-cent solution of zinc chloride used as a caustic upon the ulcers acts most favorably. If the mouth is very painful a one percent cocaine solution may be carefully painted over the affected surfaces. Silver nitrate is contra indicated. Keep the bowels open.

℞
Zinci chloridi.....gr. xl
Aquæ .....q. s. ad. fl. ℥ j
M.

Sig.: Apply upon the ulcers with a small pledget of cotton wrapped about the point of a toothpick.

℞
Glycerol. acidi tannici.....fl. ℥ ij
Aquæ .....q. s. ad. fl. ℥ j
M.

Sig.: To be painted upon the inflamed spots.

℞
Acidi borici.....℥ ij
Glycerini .....fl. ℥ j
Aquæ.....q. s. ad. fl. ℥ iv
M.

Sig.: Use as a mouth wash.

Stomatitis, Catarrhal: Acute or chronic. Follicular stomatitis. Inflammation of the mucous linings of the mouth.

Causes: Neglected mouth hygiene; ragged edges of teeth; calcareous deposits or secondary expressions of gen-

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

eral diseases, i. e.: influenza, or other infectious diseases, anemia, and during pregnancy.

Symptoms: Red and swollen mucous linings, increased salivation, thickened papillæ and turgid gums. The tongue is usually swollen and coated and shows the imprints of the teeth. A pronounced fetor from the mouth exists with painful deglutition and speech; fever is more or less present.

Treatment: Clean up the mouth; smooth all ragged edges about the teeth; loose roots must be removed. Smoking is to be prohibited. If artificial dentures are worn they should be temporarily removed. The bowels should be kept open by a saline aperient; the gum edges are cauterized with aromatic sulphuric acid or copper sulphate in substances and rigid mouth hygiene is enforced.

℞

Magnesii sulphatis.....℥ j
Acid. sulphur. dilut.....fl. ℥ ss
Syrup. limonis .....fl. ℥ j
Aquæ.....q. s. ad. fl. ℥ iv
M.

Sig.: A tablespoonful in half a glass of water every four hours.

℞

Acid. benzoici.....℥ j
Tinct. krameriæ.....fl. ℥ ss
Ol. menth. pip.....gtt. xv
Alcohol.....q. s. ad. fl. ℥ iv
M.

Sig.: Half a teaspoonful in half a glassful of warm water as a mouth wash.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

STOMATITIS, GANGRENOUS: Noma; cancrum oris; water-cancer.

An acute, rapidly progressive gangrenous ulceration of the mouth, leading to extensive sloughing and destruction of the affected parts. It is brought about by an infection which is probably specific in its nature. The disease progresses very rapidly; it is accompanied by an intense gangrenous odor and nearly always ends fatally. Its treatment belongs to the domain of the general surgeon.

STOMATITIS, ULCERATIVE: Various forms of severe disturbances of the soft tissues.

1. Mercurial stomatitis: It results from the internal administration of mercury or from inhalation of mercury vapors. Usually starting about the posterior teeth, more so if ragged tooth structure is a source of irritation. The gums are much swollen and loosened from the teeth; the teeth are loose and covered with a thick, slimy sordes of intense foul odor; salivation is much increased. Ulcerous destruction of the gum tissue terminates in gangrene. Caries and necrosis of the alveolar process and jaw bones may be the result.

Treatment: All mechanical disturbances have to be removed from the mouth; loose teeth and useless roots are extracted and the mercury treatment has to be stopped temporarily. Smoking and spiced or acid foods are prohibited. Thorough hygiene of the mouth is of prime importance. Hydrogen peroxide in combination with a metal astringent is the sovereign remedy for this affection. The much lauded potassium chlorate administration is of doubtful value. In severe cases of ulceration, iodoform or its odorless substitutes applied upon the corroded surfaces are of much benefit.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

℞

Zinci chloridi.....gr. x
Resorcinolis .....ʒ j
Thymolis .....gr. xx
Alcoholis .....fl. ʒ ij
Glycerini .....fl. ʒ j
Aquæ hydrog. dioxidi...q. s. ad. fl. ʒ viii
M.

Sig.: A teaspoonful in half a glassful of warm water every hour as a mouth wash.

℞

Iodoformi .....ʒ j
Glycerini .....fl. ʒ ij
M.

Sig.: To be painted upon the ulcerated surfaces.

2. Scorbutic stomatitis: Scurvy, scorbutis purpurea. General malnutrition or anemia brought about by an infection resultant from dietary insufficiency of fresh vegetables. The gums are much swollen, spongy and ready to bleed upon the slightest irritation. Malaise, debility and mental lethargy are pronounced. Refer to the physician for the treatment of the general condition.

SHOCK: Sudden vital depression due to injury or emotion making an untoward impression upon the nervous system. Its severity depends upon the cause, i. e.: it may be slight, transient, profound or even fatal. Recovery is followed by more or less quickening of the pulse and the respiration and an abnormally high temperature.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Treatment: It requires prompt attention. The body is placed in a recumbent position with the head lowered and the patient is wrapped in warm blankets and hot water bottles are placed about the extremities. Quickly acting stimulants, viz., whiskey or brandy by the mouth or hypodermically in one-half to one drachm doses, should be given very freely assisted by strong, hot coffee. The heart is supported with digitalis and atropine. When there has been much hemorrhage, copious draughts of hot liquids are indicated. Recovery from shock, if it occurs at all, is usually quite speedy.

Swallowing Artificial Dentures: Artificial dentures, like other foreign bodies, may accidentally be swallowed. According to Kleinmann the following points should be carefully observed in the construction of dentures:

(1) Great care should be exercised in regard to fastening dentures in the mouth. (2) It is best to advise the patient to remove such substitutes during sleeping hours. (3) Epileptics should quickly remove the artificial teeth in the beginning of an attack (aurea epileptica). (4) Before administering a general anesthetic, artificial substitutes must be removed from the mouth. (5) Dentures should not be made too small and too many clasps and sharp corners should be avoided.

Diagnosis: The œsophageal probe and the Roentgen ray are sure means.

Treatment: If the denture is caught in the pharynx, the coin catcher or other suitable instrument may help to extract it. If lodged in the œsophagus, it may be possible to gently force it into the stomach by means of a sound. If lodged in the stomach or the intestines an attempt should

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N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

be made to facilitate the removal of the denture through the natural way, viz.: the intestines. The patient should eat large quantities of asparagus, oatmeal porridge, boiled rice, or mashed potatoes, mixed to a thick mush with milk and white crochet cotton cut in pieces two inches long. The meal should be repeated every three hours. After the third portion is taken, half an ounce of castor oil is administered. Avoid purgatives in the beginning. The object is to distend the intestines and to entangle the denture in the cotton threads. This diet may be continued for several days. If the stomach or the bowels persist in retaining the denture, an operation should be resorted to.

SYNCOPE: A more or less sudden failure of the heart; extreme state of prostration.

Treatment: Fresh air, horizontal position of the patient, opening of obstructing garments and massage of the heart; dashing of cold water in the face and irritating substances, like ammonia and amyl nitrite, for inhalation. (For detailed description see the treatment of accidents of general anethesia.)

SYPHILIS OF THE MOUTH: The hard chancre (Hunterian) is the typical initial lesion of syphilis which usually appears about three weeks after infection at the point of inoculation. It is more typical in men than in women. It is a definite round or oval ulcer, having a sharply defined border and presenting a corroded surface which is covered with a whitish lard-like detritus and which secretes a thin serous fluid. The edges are often ragged and undermined.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Swelling of the neighboring lymph glands occurs in the early stages of the disease. Of all extra-genital chancres 65% are located about the mouth (lips, throat, tongue and buccal cavity). The secondary manifestations appear from four to eight weeks after the initial lesion and are ushered in with fever, malaise, and headache. A typical sore throat makes its appearance early. The diagnosis is often difficult in the early stages; the presence of certain skin eruptions (roseola) and the mucous patches make the diagnosis certain.

"There are several points which all syphilides have in common, and which, taken together, may be considered as pathognomonic of syphilis.

1. Syphilitic rashes or syphilides, are superficial. They are situated in the capillary layer or the corium of the skin and extend only superficially. There is no tendency, as in tertiary lesions, to extend into the deep tissue, and very little tendency to increase peripherally, though two or more closely situated lesions may coalesce.

2. It is only the epidermis overlying the syphilides that is destroyed and it is replaced by new epithelium.

3. If the lesion is not contaminated by pus cocci, there is no tendency to ulcerate.

The epidermis is replaced and does not leave a scar.

4. There is, however, a deposit of pigment where the syphilide occurred, which is of a characteristic ham or copper color. This spot may disappear very shortly, leaving no trace. It may appear immediately or its appearance may be delayed a few days.

6. Syphilitic rashes may or may not itch.

7. They are symmetrical on both sides of the body.

8. The roseola disappears on pressure.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

The mucous patch develops upon mucous surfaces of the skin and it is similar in structure to a papule, but it secretes a glairy fluid which is highly infected. If inoculated into a healthy person, a chancre will always result at the point of infection. Mucous patches are not painful and seldom give rise to inconvenience. In the mouth, the first manifestation of the secondary stage of syphilitic infection is the appearance of a general dull red erythema involving the entire fauces. The erythema soon fades, leaving symmetrically disposed erythematous spots on both sides of the palate, the walls of the pharynx, the pillars of the fauces, and sides of the tongue."

Tertiary manifestations may occur from two to three years or even fifteen years after the primary infection. Gummata, viz,. small defined accumulations of cells, which show a tendency to break down into ulcers and destroy surrounding tissues. The gummata of the palates destroy the soft and hard portions equally rapid; necrosis of the bone results. The ulcer finally heals but leaves a round perforation which communicates with the nasal cavity. Hereditary syphilis is characterized by typical imperfections of the permanent teeth usually confined to the upper incisors; they present crescent-like peculiar excavations at their incisive edges and they, with the other teeth, may show pitted surfaces, irregularity of position and, in general, weak structure. Pathognomonic signs of inherited syphilis are: the presence of malformed teeth, interstitial keratitis and otitis media (Hutchinson's trias).

Treatment: It is to be left to the physician. The oral cavity of the syphilitic should be brought in perfect order before medicinal treatment is inaugurated. This factor will, to a very large extent, prevent the possible occurrence of

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

mercurial stomatitis. The teeth should be scrupulously cleaned and kept in that condition during the treatment; all useless roots are removed and present cavities filled. The frequent use of astringent and antiseptic mouth washes are essential. The greatest care is to be exercised by the operator to work with sterilized instruments only to prevent a possible infection of himself or of his patients. All instruments used during treatment must be sterilized by boiling.

Differential Diagnosis.

Syphilitic Sore Throat.	Acute Tonsilitis.
History of infection.	No specific history.
Inflammation slight.	Inflammation much greater.
Little swelling.	Much swelling.
Slight rise in temperature.	Temperature high.
Little pain.	Pain very severe.
No difficulty in swallowing and opening mouth.	Difficulty in opening mouth and swallowing.
Symmetrically disposed.	Unusual unilateral.

Syphilitic Sore Throat.	Tubercular Sore Throat.
Syphilitic history.	Tubercular history. No syphilitic history.
May be in children, if so hereditary.	Usually adults.
No emaciation.	Rapid emaciation.
Little fever and pain.	High fever, much pain.
Hoarseness, no dysphagia or aphonia.	Aphonia, dysphagia, dyspnea.
Ulcer sharply defined with edges.	Ulcer superficial, indefinite edges, not undermined.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Undermined.

Situated on a thickened base with surrounding area of redness.

Duration brief.

Syphilitic Ulcer of Tonsil.

Swelling and induration slight.

Usually bilateral.

Syphilitic history.

Ulcer has indurated base.

Edges sharply defined. Undermined.

May be superficial or deep.

Little or no pain.

No cachexia.

Discharge not so offensive.

Mucous Patches.

Duration short.

Round or oval, smaller.

Seldom on cheek.

Pain very severe before and under surface of tongue.

Patches thinner.

Glands involved.

Grayish perforated appearance.

Progresses rapidly.

Anemic mucous membrane.

Cancer of Tonsil.

Much swelling and induration.

Usually unilateral.

No history of syphilis.

No indurated base.

Edges not undermined, grayish.

Profuse granulations.

Pain very severe before and after ulceration.

Cachexia marked.

Fetid discharge.

Leucoplakia Buccalis.

May last for years.

Form irregular, may grow quite large.

Frequently on cheek.

Never found in these locations.

Patches thickened.

If involved, only later.

No carcinomatous tendency.

Patches grayish or red.

Tendency to develop into carcinoma.

Patches very white.

(L. Lake Baldwin.)

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

THRUSH: White mouth; soor muguet; parasitic stomatitis.

An inflammation of the mucous lining of the mouth from a parasitic fungus, *oidium albicans,* manifesting itself in pain, disturbed deglutition, disorders of digestion and of the bowels.

Symptoms: The mucous lining of the oral cavity is covered with a whitish thick deposit which may be lifted up by an instrument. Thrush fungi are seen on microscopical examination. The pain varies with the severity of the disease.

Diagnosis: Presence of thrush fungi.

Treatment: Absolute cleanliness of the mouth, alkaline mouth washes and painting of the affected surfaces with borax or salicylic acid solutions.

℞

Sodii boratis .....3 ij
Glycerini .....f℥ss
Aquæ .....q. s. ad f℥ij
M.

Sig.: Apply 3 or 4 times daily.

℞

Acidi salicylici .....℥j
Alcoholis .....f℥ij
Glycerini .....q. s. ad f℥j
M.

Sig.: Paint upon affected surfaces 3 times daily.

TUMORS OF THE MOUTH: All forms of tumorous sarcomatous growths, known as epulis, are specially prone growths are found in the mouth. Upon the gums, giant-cell

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to occur. They have their origin in the periosteum of the tooth and they are benign in their nature. Sarcoma and carcinoma are rarely found upon the gums. From the periosteum may develop fibroma, myxoma, sarcoma, carcinoma, cysts, etc. In the floor of the mouth, retention cysts are frequent. (See Ranula.)

Treatment: Epulis is usually pedunculated; it is removed with the knife or by the galvanic cautery; care being taken to destroy the peduncle at its starting point, otherwise it will recur in a short time. (For the treatment of the retention cysts, see Ranula.)

Diagnosis and treatment of all larger tumors are to be referred to the surgeon.

WOUNDS are breaks in the continuity of the tissues. They may be incised, made by a cutting instrument; lacerated, resulting from crushing or tearing; or penetrating, made by a pointed instrument. Wounds frequently become infected.

Treatment—General; to stop the hemorrhage, tie the vessels or pack the wounds; remove crushed or lacerated tissues and close the wound by a suture or by a protective (collodion, adhesive plaster). Infected wounds with pus formation require prompt incision and pus evacuation. Remove detritus by syringing and, if necessary, with a curette. Dress with wet hot gauze soaked in solution of phenol, 2%, or mercuric bichloride, 1 in 5000. Wounds in the mouth heal comparatively readily; antisepsis should be rigidly enforced.

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TREATMENT OF ACCIDENTS OF GENERAL AND LOCAL ANESTHESIA.

The disturbances resulting from the administration of anesthetics, which to a more or less degree involve the various functions and tissues of the body, may conveniently be classified as those affecting, first, the digestive apparatus; second, the circulation; third, the respiration, and fourth, the nervous system. Disturbances in the digestive apparatus usually manifest themselves in two distinct varieties—in nausea and in vomiting. By nausea we understand that well-known sickening feeling, accompanied by retching and a desire to vomit. It is the direct result of reflex movements of the pharynx, esophagus and stomach, and is most likely caused by the irritating vapor of the anesthetic. It is primarily noticed in connection with the administration of chloroform, ether, and ethyl bromide, and rarely with ethyl chloride or nitrous oxide gas. Treatment is seldom called for, as nature usually helps herself. If we wish to overcome nausea by drug administration, small doses of spirit of peppermint or of a valerian preparation are recommended; especially validol, a compound of menthol and valerianic acid, deserves to be mentioned. Vomiting results from complicated conjoint movements of the diaphragm, the stomach walls and the glottis. It is naturally oftener noticed in cases where a full meal is taken shortly before the anesthetic is administered; it rarely occurs in laughing gas narcosis. By vomiting the stomach empties itself, and, except dieting for a short time, no further treatment is required. It is essential to clear the mouth and throat from all vomited matter as soon as possible to avoid obstruction of the air passages.

Disturbances of the circulation are very dangerous. While they can not be directly observed upon the organs

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of circulation or the blood, fortunately they manifest themselves externally to the trained eye by various color manifestations—cyanosis or extreme pallor. Cyanosis is the expression of severe congestive hyperemia, resulting from accumulation of venous blood—a subcharge of carbonic acid. The blue color appears primarily on the end organs of the body—the lips, cheeks, fingers, nose, etc. Cyanosis is always present in dyspnea and asphyxia. Lipothymia, or fainting, is a temporary inhibition of the functions of the brain, resulting from cerebral anemia, usually accompanied by more or less complete inhibition of all senses. If the heart should stop completely, general collapse may result. A specific variety of collapse which is marked by the suddenness of complete heart failure is referred to as syncope. This syncope, when occurring in the early stages of administering a narcotic, and when accompanied by a typical staring or enlarged or reduced pupils, indicates idiosyncrasy to the narcotic used. The treatment of the disturbances of circulation consists in applying mechanical and chemical means to bring about increased or renewed heart action. Artificial respiration and powerful rhythmic compression of the heart's region are essential. The compression of the heart is best accomplished by standing on the left side of the patient and forcefully pressing with the right thumb into the region between the apex of the heart and the left wall of the sternum; the left hand should be placed over the right thoracic region of the patient to steady the body, and compression should be applied about a hundred times a minute. Slapping the face and chest of the patient with towels wrung out in cold water acts as an active reflex stimulant. Nelaton suggests lowering the head, or complete inversion of the body, to promote rapid flow of blood to the anemic brain.

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Both means produce excellent results. Stimulation by chemical agents consists of applying strong irritating substances to the nostrils. In the early stages of collapse, ammonia, in the form of smelling salts or in its various solutions, acetic ether, eau de Cologne, etc., are indicated. As a powerful dilator of the peripheral vessels the vapors of amyl nitrite are exceedingly useful by placing three to five drops of this fluid on a napkin and holding it before the nostrils for inhalation; flushing of the face and an increase of the frequency of the pulse follow almost instantly. Nitroglycerin solution manifests a similar typical nitrite action. Aromatic spirit of ammonia, in half-teaspoonful doses, well diluted, is much lauded for such purposes. Perfect respiration is absolutely essential to aerate the blood in circular disturbances.

Disturbances of respiration are either mechanical or functional in their nature. To avoid possible mechanical obstruction during narcosis, which may occlude the trachea, careful inspection of the oral cavity should always be resorted to before beginning to anesthetize. Artificial teeth, removable bridges, chewing gum, tobacco and many other things may be looked for in the mouth. In extracting teeth extreme care should be exercised to actually deposit the tooth outside of the mouth. A tooth is liable to spring from the forceps, or, when forced from an alveolus by an elevator, may fall backward and enter the trachea. To avoid such an occurrence, Carter's oral net spoon has been devised. If the slipped tooth can not be caught with the finger or an instrument, an effort should be made, in extreme cases only, to force the tooth into the gullet by pushing it backward and a little to the left, thus gaining entrance into the esophagus.

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In the early stages of anesthesia, occasionally inhibition of respiration is produced by tonic spasms of the muscles of the tongue, thus forcing this organ against the soft palate and the posterior wall of the pharynx. This same phenomenon may occur during profound anesthesia in a patient assuming a recumbent position. To overcome stenosis of the larynx the lower jaw should be thrown forward by pressing against the two rami posteriorly. This movement is known as Esmarch (English) or Howard grip. A tongue forceps may be inserted and the tongue pulled forward, or piercing the tongue with a needle threaded with stout silk and applying rhythmic traction has been resorted to.

The typical organic impairments of respiration are known as apnea, dyspnea and asphyxia. The differentiation between these three forms of suffocation rests probably more with the severity of the disturbances than with the kind; they are primarily the result of a lesser or greater paresis of the respiratory centers. The supreme remedy is artificial respiration—an artificial means for the thorough ventilation of the blood and lungs, replacing the narcotic with air until normal functions of the organ are established. One of the older methods of forcing air into the system is the mouth-to-mouth insufflation, a method which today is abandoned; the same is true of the bellows method. Artificial respiration may be applied by any of the known methods that serve its purpose, provided the employed method is thoroughly understood.

Sylvester's method of resuscitation is probably most universally employed. It is carried out as follows: Place the patient on the back, with a roll of clothing under the shoulders. Pull the tongue forward and retain it in that position to allow the free entrance of air into the windpipe. The

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operator stands at the head of the patient and grasps both arms midway between the elbows and wrist joints; the arms are drawn upward until the hands are carried high above the head, and kept in this position until 1, 2, 3 can be counted slowly. The elbows are now slowly carried downward, placed by the side of the trunk and inward against the chest. This movement should be continued at the rate of fifteen to sixteen times a minute, and may be continued for an hour or more if needed.

Howard's method of resuscitation has recently been advocated. It is carried out as follows: Place the patient on the back with a roll of clothing under the thorax. All clothing obstructing the neck, chest and abdomen must be loosened. The tongue is pulled forward and held in that position to allow the free entrance of air. Kneel astride the patient's hips and place your hands on his chest; the ball of each thumb rests on the inner margin of the free border of the costal cartilages, the tip of each thumb is near or on the ensiform cartilage, and the finger tips are placed into the corresponding intercostal spaces. The elbows of the operator are firmly pressed against the patient's sides and the upper portion of his hips. Press upward and inward toward the diaphragm, and throw the weight slowly forward two or three seconds until the face almost touches that of the patient, ending with a sharp push, which helps to jerk the operator back to the erect kneeling position. Now rest three to five seconds, and repeat the same movement at the rate of seven to ten times a minute until natural respiration is established.

Faradization of the diaphragm is sometimes useful; too much should not, however, be expected from the electric current in this connection. Dilating the anus with a suitable

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speculum is also recommended. A careful and quickly instituted artificial respiration is the alpha and omega of all methods of resuscitation. The proper use of the first minute is of more real value in the preservation of the extinguishing life than all the hours thereafter. No precious moments should be lost by rubbing the patient, applying smelling salts, or other secondary means. Artificial respiration may often be profitably continued for an hour or longer until fairly normal lung activity is established.

As far as medication is concerned, the only drug that has proved to be of value in this connection is strychnine in full doses by means of hypodermic injections.

Nervous disturbances during or following anesthesia usually manifest themselves in two definite forms—in those affecting the psyche and those unbalancing the motor centers. Psychic excitement is a common occurrence in the preliminary stages of narcosis; hysterics and alcoholics furnish by far the largest contingent. Intense muscular exertion, combined with clonic or tonic spasms, frequently result in an increased pulse rate, with more or less cyanosis and stertorous respiration. If we possess an anamnetic clue in regard to existing hysteria or alcoholism, a hypodermic injection of morphine half an hour before beginning of the narcosis will materially lessen this preliminary excitement. Occasionally we meet a patient who will awake from the anesthetic with apparent normal physical condition, but without perfect control of the sensorium. The patient remains for some minutes in a sort of lethargic sleep, which may at times reach a deep comatose state. Swelling salts held to the nostrils, cold water dashed in the face, and loud talking or shaking will arouse the patient. Disturbances of the motor centers result in more or less severe spasms. Singul-

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tus, the ordinary hiccough, is often seen in the early stages of inhalation. Tremor of a single group of muscles or of the entire body is noticed more or less frequently after the taking of smaller quantities of the narcotic; similar tremors as a result of indulging in other narcotics—as tea, coffee, or tobacco—are noticed in those who are not habitues of these drugs. These muscle tremors are usually confined to the early stages of inhalation, and are not dangerous. If they should occur after the anesthetic passes off, the strong will power of the patient materially assists in readily overcoming these tremors. Convulsions, combined with clonic or tonic spasms, occur frequently under nitrous oxid anesthesia, but much less under the other narcotics. Care should be exercised to prevent the patient from hurting himself. The removal of the anesthetic quickly relieves the condition. Tetanus—the persistent contraction of voluntary muscles—is frequently seen in the early stages of anesthesia; loss, however, when chloroform is used. Typical trismus—tonic spasms of the muscles which are supplied by the fifth pair of nerves, especially those of mastication—is often very troublesome in dental anesthesia. As a precaution, a suitable mouth prop should always be put in place. Severe forms of tetanic convulsions, bending the head and feet backward, known as opisthotonus, are also seen under anesthesia in the early stages. All these muscle disturbances rarely call for treatment, but carefully watching the patient to prevent hurting himself is, however, indicated.

The typical picture of cocaine poisoning is produced when the blood flowing through the central nervous system contains a sufficient quantity of the drug, even for the moment only, which is dangerous to this organ. No maximum dose of cocaine can be positively established; this is

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equally true of chloroform and ether when used for general anesthetic purposes. The many cases of so-called idiosyncrasy probably find an explanation in the too large doses which formerly were so frequently administered.

The danger of poisoning with cocaine preparations has been practically eliminated with our increased knowledge of its action on the tissues. At present solutions containing a relatively small percentage combined with adrenaline are usually employed, and, when injected with the proper technique, dangerous results are comparatively rare. No direct antidotes of cocaine are known.

The treatment of general intoxication is purely symptomatic. Anemia of the brain, which is of little consequence, may be readily overcome by placing the patient in a recumbent position, or by complete inversion if necessary. As a powerful dilator of the peripheral vessels, the vapors of amyl nitrite are exceedingly useful; it is best administered by placing 3 to 5 drops of the fluid on a napkin held before the nostrils for inhalation. Flushing of the face and an increase in the frequency of the pulse follows almost instantly. Nausea may be remedied by administering small doses of spirit of peppermint, aromatic spirit of ammonia, orvalidol. The latter deserves special recommendation. To overcome the disturbances of respiration, quickly instituted artificial respiration is the very best procedure in all methods of resuscitation; the only drug that has proved to be of value in this connection is strychnine in the form of the sulphate or the nitrate in full doses by means of hypodermic injections.

In dental literature reference is frequently made to "shock from the anesthetic." By shock is meant the depression resulting from an injury or an operation, and we are inclined to believe that these "shock stories" of anesthesia

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can be properly placed under the various disturbances within the four divisions of anesthesia sequences if a correct diagnosis is made.

For the purpose of readily meeting unexpected side effects of anesthetics, every practitioner should provide himself with a stock of emergency drugs, placed in an easily accessible compartment of his medicine chest, consisting of:

Hypodermic tablets of strychnine sulphate, 1-30 grain.
Hypodermic tablets of nitroglycerine, 1-100 grain.
Amyl nitrite, in 5-drop glass capsules.
Validol.
Aromatic spirit of ammonia.
Smelling salts.
Whiskey.
Hypodermic syringe in good working order.

IMMEDIATE TREATMENT OF ACUTE POISONING.

General Directions.

When a poison has been swallowed, the stomach should at once be evacuated with the stomach tube, or, in its absence, with a fountain syringe. If corrosives have been swallowed and the mucous membranes are greatly swollen, the stomach tube is not indicated, as laceration of the soft tissues may follow. Emetics are of prime importance. Certain metallic salts, especially copper sulphate in 3-grain (0.2 Gm.) doses, and zinc sulphate in 10-grain (0.65 Gm.) doses, dissolved in a glassful of water, act very promptly. If the patient is unable to swallow, apomorphine hydrochloride, 1-10 grain (0.006 Gm.), hypodermically, acts promptly and vigorously. As an emergency remedy a tablespoonful of ground mustard stirred in a cupful of tepid water usually produces quick vomiting. If the poison is of an unknown

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origin, emetics, bland liquids and stimulants, together with suitable systematic treatment, is indicated.

Acetic, Hydrochloric, Nitric, Nitro-Hydrochloric and Sulphuric Acids.

No emetic should be given. To dilute and neutralize the acid, milk mixed with chalk, whiting, magnesia, or baking soda, strong soap suds, or white of egg beaten up with water, is given; later oil and mucilaginous drinks of flaxseed or slippery elm are indicated. Usually intense ulceration follows the acid burns. To relieve pain, morphine sulphate, ¼ grain (0.015 Gm.), or tincture of opium, 15 drops (1 Cc.), is administered.

Hydrocyanic Acid and All Cyanides, Alcohol, Chloroform, Ether, Chloral Hydrate, Gasoline, Carbon Bisulphide and Sulphurets of the Alkalies.

Hydrocyanic acid and cyanides require very prompt measures; they are quick and powerful poisons. Emetics may be given if necessary. The patient is put in a recumbent position, the head lowered and plenty of fresh air for free respiration. Persistent artificial respiration should be instituted if needed. Keep the body warm and try to arouse the patient with ammonia vapors; put cold douches to his head and apply friction to the extremities. Strong stimulants—whisky, nitroglycerine solution in ½ drop doses, etc.—are indicated.

Oxalic Acid and Its Salts.

Give chalk or whiting mixed with two tablespoonfuls of vinegar and an equal quantity of water; do not give soda or potash with the object of neutralizing the acid.

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Vomiting should be induced at once and followed by olive oil or mucilaginous drinks. General stimulants—whisky, etc.—and warmth applied to the extremities are essential.

Phenol (Carbolic Acid) and Its Compounds, Cresol, Creosote, Lysol and Resorcinol.

Induce vomiting and give large quantities of diluted whisky or magnesium sulphate solution in the early stages. Remember that alcohol is not a chemic antidote for phenol or its compounds. Later give bland liquids, olive oil and general stimulants as required.

Caustic Alkalies and Ammonia.

Promote vomiting by large draughts of warm water. Mild acids in the form of diluted vinegar or lemon juice are indicated, which should be followed by olive oil, white of egg beaten up with water and mucilaginous drinks. Severe pain calls for morphine sulphate, ¼ grain (0.015 Gm.) or tincture of opium, 15 drops (1 Cc.).

Arsenic and Its Compounds.

Promote vomiting with large draughts of warm water and administer at once hydrated oxide of iron (the official antidote for arsenic) or dialyzed iron. The official antidote may be prepared extemporaneously by mixing a teaspoonful of calcined magnesia with a cupful of water, add three teaspoonfuls of tincture of iron chlorid, mix well and give the whole of it at once. This is to be followed with olive oil, white of egg beaten up with water and mucilaginous drinks.

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Antimony Salts, Copper, Iodine and Its Preparations, Mercury Salts, Potassium Bichromate, Tartar Emetic, Tin and Its Salts, Colchicum, Cantharides and the Oils of Croton, Savin and Pansy.

Induce vomiting and is usually produced by the metallic salts themselves. Give large draughts of raw white egg (about half dozen or more) beaten up with water, or flour stirred in water, strong tea or coffee and general stimulants. To relieve pain and tenesmus, morphine sulphate, ¼ grain (0.015 Gm.) is indicated.

Barium and Lead Salts.

Give magnesium sulphate, 4 drams (15 Gm.) or sodium sulphate, 1 ounce (30 Gm.), dissolved in a large tumblerful of water. Promote vomiting by warm water or with mustard and follow with milk and demulcent drinks. Pain is relieved by morphine sulphate, ¼ grain (0.015 Gm.) or tincture of opium, 15 drops (1 Cc.).

Silver Nitrate.

Give common salt, one-half tablespoonful dissolved in a tumblerful of warm water and induce vomiting; later, large draughts of demulcent drinks—starch, flaxseed or slippery elm stirred in water—are indicated.

Phorphorus (Rat Paste, Etc.).

Give a prompt emetic—copper sulphate, 3 grains (0.03 Gm.), dissolved in a tumblerful of water—every five minutes. Old, thick oil of turpentine in 1-dram (4 Cc.) doses, suspended in flour water and repeated every hour, is much lauded. Do not give oils or fats. Milk of magnesia is often beneficial. When indicated give general stimulants.

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Atropine, Cocaine, Gelsemine, Pilocarpine and All Preparations Containing These Alkaloids.

Induce vomiting, give large draughts of warm water, strong coffee and tea and general stimulants. If the patient is drowsy, rouse him with ammonia vapors; apply heat to the extremities and institute artificial respiration if necessary.

Aconite, Cotton Root, Digitalis, Ergot, Lobelia, Tobacco, Veratrum and Preparations Containing These Substances.

Give an emetic, which should be followed by large draughts of warm water, strong tea or coffee. Keep the patient in a horizontal position, apply warmth and friction to the extremities and use artificial respiration if needed.

Opium and Its Preparations, Morphine and Its Salts and Indian Hemp.

If necessary, vomiting should be induced. Give strong tea or coffee and large draughts of warm water. Keep the patient awake and, if possible, in motion. A cold douche is beneficial. Strychnine sulphate, 1-30 grain (0.002 Gm.) and atropine sulphate, 1-100 grain (0.0006 Gm.), administered hypodermically, are often of benefit. Persistent artificial respiration should be kept up, even after life seems to be extinct.

Nux Vomica and Its Preparations, Strychnine and Its Salts and Fishberries (Cocculus Indicus).

Induce vomiting, followed by large draughts of warm water, and give tannic acid in 1 percent solution or iodide of starch. Spasms are relieved by inhalation of chloroform or by chloral hydrate, 15 grains (1 Gm.), dissolved in a

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tumblerful of water. Evacuate the bowels and give the patient absolute rest.

Formaldehyde and Its Solutions.

Give ammonia in very diluted solutions and demulcent drinks. General stimulants should be given when indicated.

Wood Alcohol.

Give immediately a tablespoonful of common salt, dissolved in a large tumblerful of warm water, and repeat with strychnine sulphate, 1-30 grain (0.002 Gm.), hypodermically and give strong coffee or tea.

Decayed Meat or Vegetables.

These materials are often productive of ptomaine poisoning. Induce vomiting and cleanse the bowels with full doses of castor oil. Strong stimulants and heat and friction applied to the extremities are beneficial.

Poisonous Fungi.

Evacuate the stomach as quickly as possible by promptly acting emetics. Give atropine sulphate, 1-100 grain (0.0006 Gm.), hypodermically and tannic acid in the form of strong tea or coffee.

URINE ANALYSIS.

Urine analysis as an aid in diagnosticating certain dental diseases is an essential adjunct to the clinical examination of the patient. Oral manifestation of typical general diseases—as diabetes, gout, autointoxication, etc.—are often the first pathognomonic signs of these diseases. The cor-

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rect diagnosis of the latter is verified by a urine analysis and the patient may be surprised to learn that the presence of an odor of acetone from the oral cavity, together with the formation of pericemental abscesses and the rapid accumulation of soft white calcareous deposits about the teeth should be indicative of diabetes, of which he has no knowledge at the time. The presence of sugar in the urine will verify the diagnosis. A urine analysis is also of important value to the dental practitioner if he intends to administer a general anesthetic—chloroform or ether—to a patient. For the foregoing purposes an exhaustive examination of the urine is not necessary; it is merely intended to ascertain by a few simple tests the presence or absence of albumin, of sugar, of the approximate amount of uric acid, etc. The determination of these substances may also indicate if the assistance of the family physician is desired in the treatment of the case under observation. An intelligent report made to the physician will not merely insure the co-operation of the latter, but may also assist in bringing about a better understanding and a much desired closer relationship of the two professions.

The normal quantity of urine voided in twenty-four hours varies from 40 to 50 ounces (1,200 to 1,500 Cc.). Free perspiration decreases the quantity, while chilling of the skin increases it. The greatest portion of urine is passed during the day; during the night and the early morning hours the least portion is passed. Usually the urine has a light, amber color, due to urobilin; the color depends, however, largely on the quantity voided. On standing, nearly all normal urine assumes a cloudy appearance, which is due to the presence of mucus. The normal reaction of urine is slightly acid, due to uric acid, hip-

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puric acid, or acid sodium phosphate. After meals the reaction may be neutral or even alkaline for a short time. The normal specific gravity varies from 1.015 to 1.025; it is low when an increased amount is passed and high when the quantity is diminished. Normal urine has a peculiar, aromatic odor; it is altered by certain food or drugs—asparagus and oil of turpentine produce a violet-like odor, garlic gives a garlic-like odor, etc.

The solid constituents of urine consist of organic and inorganic compounds and they vary very markedly. The solids held in solution by and excreted with the urine within twenty-four hours amount to approximately:

308 to 617 grains (20 to 40 Gm.) urea.
6 to 12 grains (0.36 to 0.78 Gm.) uric acid.
9 to 14 grains (0.54 to 0.90 Gm.) ammonium, calcium, magnesium, potassium and sodium urate.
12 to 45 grains (0.72 to 2.9 Gm.) sodium phosphate.
154 to 237 grains (10 to 25 Gm.) sodium chloride.

General Examination.

For the examination of the urine the mixed total quantity voided during the twenty-four hours or a part thereof should be submitted. The preliminary inspection begins with the color of the sample; the latter may be expressed as pale straw, straw, pale amber, amber, dark amber, reddish amber, etc., or after Vogel's scale of colors. It should not be forgotten that certain drugs which are taken internally may impart a distinctive color to the urine—santonin produces an intense yellow color, which changes to red or purple when alkalies are added; methylen blue produces a blue color, etc. The odor is recognized as normal aromatic,

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as ammonical or as putrid; the reaction is obtained with sensitive litmus paper. The specific gravity is readily determined by the urinometer, the specific gravity bottle, or by the specific gravity beads. If it is above 1.025, sugar in appreciable quantities may be expected. The instruments used for this work are usually corrected to conform to a temperature of 60 degrees F. (15 degress C.). If the temperature is above or below this standard one degree of the urinometer has to be respectively added or subtracted for every 5 degrees F. (2.8 degrees C.).

Tests for Albumin.

Serum albumin is the most often tested for of any constituent of the urine, and of the many tests which have been proposed the following are to be preferred. No single test is sufficient.

1. Heat Test.—Boil the urine in a test tube; when an opalescence appears it indicates the presence of albumin or an excess of phosphate. If a few drops of nitric acid are now added the cloudiness will disappear if due to phosphate, but will remain permanently if due to albumin.

2. Purdy's Modified Heat Test.—Fill the test tube three-quarters full with urine and add saturated sodium chloride solution to fill the tube; now add two or three drops of strong acetic acid and, holding the tube in the fingers by its bottom, heat the upper layer of the fluid until the mixture boils; then, without shaking the tube or its contents, examine the layer of fluid in the upper part of the tube, comparing its degree of transparency with that of the fluid that was not heated in the lower part of the tube. If the heated portion of the fluid is in the slightest degree hazy or less transparent, albumin is present.

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3. Heller's Nitric Acid Test.—A test tube is filled to the depth of one-half inch with nitric acid, and while being held in an inclined position, the clear (filtered, if necessary) urine is allowed to trickle slowly down the inside surface from a medicine dropper, so as to form a superimposed layer on the urine. An opalescent ring at the junction of the two liquids indicates albumin. Excess of urates, mucus, etc., sometimes gives rings resembling those of albumin, but on close observation these rings will be seen to be slightly above in the column of urine instead of at the bottom of contact.

Tests for Sugar.

Sugar occurs less frequently in the urine than albumin, and is usually present in urine having a very high specific gravity—above 1.025. If a sample of the urine contains albumin, it should always be removed by boiling and filtering before any of the tests for sugar are applied.

1. Fehling's Copper Test.—Equal volumes of the ordinary Fehling's solutions are mixed in a test tube and heated to the boiling point; if no reduction occurs, the solution may be considered safe, and the urine is now added drop by drop to the boiling Fehling's solution until an orange color or reddish precipitate forms, or until a volume of urine equal to that of the copper solution has been added. If there is no precipitate of orange or reddish cuprous oxide, sugar may be considered absent. Simple discharging of the color of the formation of various bluish-gray precipitates must not be mistaken for a true reduction.

2. Trommer's Modified Copper Test.—Place one inch of urine in a test tube and add one-half inch of potassium

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hydroxide solution, U. S. P., to the urine. Mix the two fluids by shaking the tube and add two or three drops of a 5 percent solution of copper sulphate in distilled water. Do not heat the mixture, but allow the tube to stand undisturbed for twelve to twenty-four hours in the cold. At the expiration of that time, if sugar be present, there will be collected in the tube an ochre-yellow to brick-red precipitate of fine sand-like character of suboxide of copper.

Quantitative Estimation of Sugar

The quantity of sugar in urine is very conveniently and quickly estimated by using "soloid" tablets of copper sulphate and alkaline tartrate (1). It is based on Fehling's reduction test as follows:

Prepare a standard test solution of dissolving four "soloids" copper sulphate in about 2 cubic centimeters of distilled water and in this solution also dissolve 4 "soloids" alkaline tartrate, then adjust to 4 cubic centimeters at 15 degrees C. Each cubic centimeter corresponds to 0.005 gram of anhydrous glucose. It may be found more convenient to dilute the above measure of 4 cubic centimeters with an equal volume of water, when each cubic centimeter of diluted test solution will correspond to 0.0025 gram of anhydrous glucose. Make a rough estimation by adding the urine to a definite volume of the boiling test solution in such quantity that, after boiling and allowing the precipitate to subside, the blue color of the reagent is just discharged. Now dilute the urine (if necessary) until it contains 0.5 to 1 percent of sugar and make an accurate estimation with the diluted urine.

[1] "Soloid" tablets are made by Burroughs Wellcome & Co., of London and New York.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Tests for Uric Acid.

The presence of an excess of uric acid or of urates is usually readily detected by the physical appearance of the urine itself. If the urine has stood in a vessel from three to four hours and a sediment of red sand ("brick dust deposit") is seen in the bottom of the vessel, it usually points to an excessive excretion of urates. The urates are more soluble in hot water than in cold water and consequently the urine may be clear on voiding, but after becoming cold may deposit quite a sediment. The amorphous urates readily dissolve on warming. Under the microscope uric acid appears as whetstone-shaped crystals, which are sometimes arranged in rosettes. These crystals are usually of a yellowish-red color.

1. Hopkin's Test.—To 100 cubic centimeters of urine add 33 grams of ammonium chloride. Shake or stir until it dissolves and then allow to stand in a cool place for three or four hours. Collect the precipitated ammonium urate on a filter and wash with saturated ammonium chloride solution until the filtrate is clean. Spread out the filter on a square glass plate and wash the precipitate down over one corner of the plate and into a beaker or flask with hot water. The contents of the beaker are now heated to boiling with an excess (10 cubic centimeters) of hydrochloric acid and allowed to stand in a cool place for several hours (not less than three), when the uric acid will crystallize out. This is collected on a small filter (the volume of the filtrate being noted) and washed slightly with cold water. Wash off the filter into a flask with hot water, enough sodium carbonate solution being added to dissolve the uric acid, the volume is made up to 100 cubic centimeters with water, 20 cubic centimeters of sulphuric acid

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are added and a decinormal potassium permanganate solution run in from a burette until a faint pink coloration remains one minute after shaking. Each cubic centimeter of decinormal permanganate equals 0.007 grams of uric acid, to which must be added 0.001 gram for each 15 cubic centimeters of the filtrate before noted.

2. Murexid Test.—Evaporate to dryness at a low heat over an alcohol lamp a few drops of urine in a watch crystal, add a drop or two of nitric acid and again cautiously evaporate to dryness. A red residue will remain. Now add a drop or two of ammonia solution without at first letting it come directly in contact with the residue. The formation of murexid, which is shown by a beautiful purple color (purpurate of ammonia), indicates uric acid or urates.

Test for Indican.

Salkowski's Test.—Eight cubic centimeters of urine with 1 cubic centimeter of a 10 percent copper sulphate solution are mixed with an equal volume of hydrochloric acid of a specific gravity of 1.19. A few cubic centimeters of chloroform are added and the mixture inverted a number of times. The indican (indol-potassium sulphate) having been split up, the chloroform extracts the resulting indigo and takes on the characteristic blue color. The quantity is estimated by the depth of the blue color.

If the urine contains albumin, it must be removed before applying this test; otherwise the blue color often arising from the admixture of hydrochloride acid after standing may prove misleading. (Purdy.)

Test for Urobilin.

Strauss' Test.—The urine is acidulated with acetic acid and cleared by the addition of one-fourth of its volume

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of 10 percent lead acetate solution and filtration. The filtrate is then shaken with amyl alcohol, the urobilin being thus extracted, as is shown by the yellow to deep orange color. The addition of ammonious zinc chloride causes a fluorescence. Urobilin in very small quantities is present in the healthy urine.

SALIVA ANALYSIS.

(After Dr. Henry C. Ferris.)

History of chronic diseases.

Description of teeth and character of caries.

Amount of saliva. Normal average, 60 Cc. per hour; 20 Cc. required for examination.

Consistence: Report sticky, thick or thin.

Odor: Ammoniacal, sweet, sour, etc.

Specific gravity: Normal 1.002.

Precipitate: Centrifuge entire amount and record in terms of centrifuge scale. Then take 5 Cc. of this and dilute with an equal quantity of distilled water, which will become cloudy if globulin is present. Centrifuge again and record amount of globulin. Pour off supernatant fluid again in the centrifuge tube; add four drops of glacial acetic acid, which precipitates the mucin. Pour off supernatant fluid and add 1 Cc. of 10 percent. solution potassium ferrocyanide; if albumin be present specimen will become cloudy. Centrifuge as before and record quantity of albumin.

Enzymic action: Take immediately upon delivery. Make 2 percent solution of starch paste, according to the following directions:

Mix starch with half the quantity of cold water and let stand for five minutes; then add the rest of the water

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and boil for ten minutes. Take 5 Cc. of this solution in test tube and place in incubator at temperature of 55 degrees C., to which add ½ Cc. saliva, let stand for one minute and boil to kill action of enzyme. Centrifuge and read scale, which will give percentage of reduction of starch to dextrin. To determine further the product of the reaction, take 2 Cc. of the clear solution and add 1 Cc. of iodine solution N/250. If starch is present the reaction will be deep violet (iodide of starch); if a light violet, it indicates a partial reduction of starch, or erythrodextrin; a colorless result indicates complete reduction of starch to dextrin.

Proteolytic test:

1 Cc. Fehling copper solution.
5 Cc. Fehling alkaline.
94 Cc. 1 0/00 sodium carbonate solution.
Dissolve in the solution 1 decigramm casein C. P.

Take 5 Cc. of the above and place in the incubator at temperature of 50° to 55° C.; then add ½ Cc. saliva, if there is a string proteolytic action in a few seconds, the color turns to pink; if it is of medium action to violet; if no action, to a dirty blue color. The first represents peptones; second, albuminose; third, unsplit caseine.

Oxydase Test.

Take 1 Cc. saliva, 4 Cc. distilled water, 12 drops of a 10 percent solution of sulphuric acid, then mix and add drop by drop 0.5 percent aqueous solution of metaphenylenediamin. If there is no oxydase, it stays without color. If there is an oxydase, there is formed triaminphenylin, which makes the solution strongly yellow.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Test for Acid Index.

Should be ascertained as soon as specimen is delivered. Use 1/40 normal sodium hydrate solution in 5 Cc. buret. The degree of acidity is obtained by taking 5 Cc. of saliva and adding 2 drops of phenolphthalein solution, neutral, then drop by drop 1/40 normal solution sodium hydrate until a rose color is produced. Having noted on paper the number of Cc. of the sodium hydrate solution in the buret before and after the rose color is obtained, the number of Cc. displaced multiplied by 20 and divided by 4 (in order to find the number of Cc. sodium hydrate solution necessary to reduce 100 Cc. saliva) equal the degree of acidity. Normal being alkaline.

To attain a more accurate result add 1 Cc. of 1/10 normal hydrochloric acid solution and boil to drive off the carbonic acid; titrate as before and subtract the acid index of the hydrochloric acid from result.

Test for Alkalinity.

Proceed as above, substituting 1/40 normal hydrochloric acid for sodium hydrate and methyl orange for phenolphthalein and titrate.

Ammonia or Organic Matter.

Take 2½ Cc. saliva and 1 drop phenolphthalein solution and titrate it with N/40 sodium hydrate solution to a feeble pink color. The used Cc. of the sodium hydrate solution gives the acidity in relation to phenolphthalein. Take formalin and put in 1 drop phenolphthalein solution and titrate it with NaOH solution to a feeble pink color.

Now both solutions are neutral or feebly alkaline to

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phenolphthalein; but if you put 1 Cc. of this neutralized formalin to the neutralized saliva the pink color disappears, because the ammonia is used up by the formalin. Now titrate a second time with N/40 sodium hydrate until the reappearance of the pink color. This amount corresponds to the amount of ammonia. Multiply the Cc. by 0.017 and you have the percentage of ammonia in the saliva. Proof: 2½ Cc. and N/40 has the same relation as 100: N/1; therefore, the amount of grams in the amount of Cc. normal solution (instead of used N/40 sodium hydrate solution) gives the percentage. Ammonia has the atomic weight of 17, therefore 1 Cc. normal solution corresponds to 0.017 percent and any amount of Cc. used must be multiplied by 0.017 percent.

Sulfocyanate Test.

Use colorimetric scale (Eimer & Amend), 1 Cc. of specimen in tube A, 1 Cc. of 1: 2,000 ammonia sulfocyanate in tube B; add 2 drops of 5 percent ferric chloride to each tube, add distilled water until color in B matches that of specimen. Read scale in thousands and ten thousands. Care must be taken to have the bottom of the meniscus on the line.

Chlorine.

To 1 Cc. of specimen add 2 or 3 drops of potassium bicromate 1 percent solution; then titrate with N/10 silver nitrate solution until a light brick-red color is attained. Multiply the buret Cc. used by 0.3545. The result will show the amount of chlorine.

Urea.

To attain the amount of urea, use a Ferris' modified Doremus ureometer, supplied by Eimer & Amend, New

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York. Tube A is washed with water and filled with hypobromite solution; close the stopper and fill tube B with 1 Cc. of specimen; open the stopper, allow specimen to enter tube A and close stopper. After all bubbles of gas have disappeared, the reading is taken. The degrees marked upon the tube are divided into 0.025 and represent the number of grams or grains of urea contained in the amount of saliva employed. (The normal relation between the chlorine and the urea in the urin is 1:2.)

Acetone.

In 4 drops of specimen dissolve a crystal of potassium carbonate, then add a drop of Gram's reagent. An odor of iodoform indicates acetone. (Care must be taken not to confound the odor of iodine in Gram's reagent with that of iodoform.) To mount slide and examine with microscope for crystals of iodoform is best test.

Total Solids and Ash.

To obtain total solids cleanse and weight a platinum dish, into which place 2 Cc. of specimen. Dry in the incubator at 100° C. from two to three hours. Care should be taken that it does not turn too black. Weight again and add to this 2 or 3 drops of fuming nitric acid. Evaporate the acid and burn it white. Weigh again. The first gives the total of solids and the second the amount of ash.

Note A: To determine the percentage of chlorine in total solids, you multiply the chlorine by 110 and divide by total solids.

Note B: In urine the normal amount of chlorine is 15 percent of total solids and it is reduced in pathological states.

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DIAGNOSTIC HINTS.

Frequency of Pulse.

At birth	130-150	times a minute
At the first year	100-130	" "
At the seventh year	72- 90	" "
At the time of puberty	80- 85	" "
At middle life	69- 75	" "
At old age	50- 60	" "

Frequency of Respiration.

At the first year	35	times a minute
At the second year	25	" "
During time of puberty	20	" "
Above twenty years of age	18	" "

Temperature of the Body.

Normal temperature	97½- 98½	° F.
Feverishness	99 -100	° F.
Slight fever	100 -101	° F.
Moderate fever	102 -103	° F.
High fever	104 -105	° F.
Intense fever	105 -	° F.

Comparison Between Temperature and Pulse.

A temperature of	98°	F.	corresponds	to	a	pulse	of	60
" " "	99°	F.	"	"	"	"		70
" " "	100°	F.	"	"	"	"		80
" " "	101°	F.	"	"	"	"		90
" " "	102°	F.	"	"	"	"		100
" " "	103°	F.	"	"	"	"		110
" " "	104°	F.	"	"	"	"		120
" " "	105°	F.	"	"	"	"		130
" " "	106°	F.	"	"	"	"		140

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CHAPTER IX.

MISCELLANEOUS.*

FORMULAS FOR MAKING NEGATIVES, LANTERN SLIDES AND X-RAY WORK.

Developer for Contrast Work, Lantern Slides, Etc.

1.

Hot water, pure	18 parts
Metol	1 part
Hydrochinone	⅛ part
Sodium sulphide, cryst	6 parts

2.

Water, pure	80 parts
Sodium carbonate, cryst	5 parts
To develop take:	
Water, pure	2 parts
Solution No. 1	1 part
Solution No. 2	2 parts

*Under this heading technical formulas and preparations are enumerated, which may be more or less useful. They actually represent a part of many inquiries which were received by the author from dental practitioners during the last few years.

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Developer for View Work.

No. 1.

Water, pure	64 parts
Eikonogen	1 part
Hydrochinone	⅛ part
Sodium sulphide, cryst	2½ parts

No. 2.

Water, pure	64 parts
Potassium carbonate (dry)	2½ parts
To develop take:	
Solution No. 1	2 parts
Solution No. 2	1 part

and add developer (solution previously used) a sufficient quantity to produce best results.

Quickly Acting Photographic Developer.

A soft effect is obtained in negatives of portraits by using iron oxalate developer containing a small quantity of sodium thiosulphate. The following is said to give a good developer:

Solution of ferrous sulphate (1:3)	25 Cc.
Solution of potassium oxalate (1:3 and containing 5 drops of chemically pure sulphuric acid)	75 Cc.
Solution of potassium bromide (1:10)	4 drops
Solution of sodium thiosulphate (not more concentrated than 1:200)	12 drops

This solution develops the plate two or three times more rapidly than those ordinarily used and gives finer

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gradations in the tones. Contrasts can be heightened by increasing the quantity of potassium bromide, i. e.: 12 drops of potassium bromide solution and 12 drops of sodium thiosulphate to 100 C. C. of the developer.

Methods for Quick Developing of Films, Plates, Etc.

For films one may use the widely advertised developing machine, or, better still, the new system of tank development recently introduced. By this method the film is wound up in broad daylight, by means of a transfer box, in a light tight apron, and immersed in a cup containing the developing solution and allowed to develop, the period depending upon the formula used and its temperature. When development is completed the developer is poured off and the cup filled with water two or three times to rinse off the film, which is then transferred to the fixing solution, all being done in daylight.

With plates, practically the same method of procedure is followed except that a dark closet is required, so that the plates may be safely transferred from the holders to the developing tank. This having been done, the tank may be covered and the room made light and the plates left until development is completed, and the time required for this having been determined beforehand by regulating the strength and temperature of the developing solution.

In selecting a developer for this kind of work it is of the utmost importance to have one which has absolutely no tendency to fog and which is not seriously affected by changes in temperature. Given a developing agent with these characteristics, a formula should be used which is susceptible to many modifications.

No developing agent fills the first mentioned specifica-

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tion as well as Edinol and the following formula cannot be equaled for versatility:

Water	2,500 parts
Acetone sulphite	75 parts
Sodium sulphite (des.)	225 parts
Edinol	30 parts
Hydroquinone	15 parts
Potassium bromide	7 parts
Potassium carbonate	480 parts

For regular tray development, dilute this stock solution with five parts of water.

For machine development, dilute with 6 parts of water and develop for 6 minutes at a temperature of 65° F.

For tank development (either plates or film) to take ten minutes, dilute with ten parts of water and have temperature at 65° F.

For the tank development (plates or film) to take 30 minutes, dilute with 25 parts of water and have temperature at 65° F.

Any other state of dilution may be used and development may be prolonged for several hours if desired. In using extreme dilutions, however, it is advisable to wet the plate thoroughly before immersing it in the developer. This will prevent "freaks," which are irregular streaks and which sometimes occur with certain makes of plates.

In addition to the above directions it may be well to mention, especially for the benefit of X-ray workers, the following modifications: To increase contrast omit the acetone sulphite. To increase softness omit the hydroquinone and add an equivalent quantity of edinol.

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Another method of time development is the factorial system. The factor being a certain number, which when multiplied by the number of seconds elapsed between the immersion of the plate in the developer and the first appearance of the image, gives the time in which the development should be completed. The factor of the above formula is 15.

Besides the simplified methods of development, photographic printing has also been made much easier since the introduction of the various so-called gaslight papers.

With these papers any negative may be printed by any kind of artificial light in a few seconds and the developing and printing done in a few minutes longer. The directions for using papers of this kind are so complete and so simple that it is unnecessary to go into the matter here, except to give a formula with which superb results can be obtained and which keeps indefinitely even in open bottles. It is as follows:

Water	4,000 parts
Edinol	30 parts
Acetone sulphite	150 parts
Sodium carbonate (des.)	225 parts

Bromide, 1 percent; solution, 5 drops to the ounce.

After adopting the above simple method of working it is unnecessary to sit up all night washing negatives and prints. The new hypo-destroyer "Bayer" will be found to reduce the time of washing to 8 minutes.

Plain Fixing Bath.

The plain fixing bath is a solution of sodium hyposulphate of a strength of about five or six parts to sixteen

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parts of water. A fully saturated solution diluted with an equal quantity of water is about this strength. The plate should be left in the fixing bath for several minutes after it appears to be cleared; as long as it took to fix would not be too much. Neglect of this precaution may lead to the formation of insoluble compounds in the film, which, although not visible at first, may in time result in stains or even total decay of the negative. Commercial hyposulphite of soda usually contains foreign matter, which, if allowed to remain in the solution, will cause spots on the negative. Filter before use. If the regular fixing bath is too strong and not stirred before use, it will at times cause parallel lines on the negatives that were fixed in grooved fixing boxes.

A cool fixing bath can be prepared by dissolving a fresh lot of "hypo" for each batch of plates. This is of benefit during the hot weather.

Acid Fixing Bath.

Owing to the quality of the water in some localities, some workmen prefer an acid fixing bath. The following is good and remains clear (mix in order given):

Water (about)	960 parts
Sulphuric acid	3 parts
Sodium sulphite	32 parts

When dissolved, add:

Sodium hyposulphite	32 parts
Water, to make	160 parts

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Acid Chrome-Alum Fixing Bath.

(For hot weather use.)

Water (about).....800 parts
Sulphuric acid..... 3 parts
Sodium sulphite..... 32 parts
When dissolved, add:
Sodium hyposulphite.....256 parts
Dissolve and then add:
Chrome-alum, from.....8 to 15 parts

previously dissolved in 120 parts of water. Then add water to make 1,280 parts.

Dry Plates.

For snapshots, landscapes and general outdoor work: Cramer's Crown plates, Hammer's fast plates or Seed's No. 27 plates.

For copying drawings, interior views and all time exposures: Cramer's Banner, Hammer's slow plates and Seed's No. 23 plates.

Lantern Slide Plates.

These special plates are made by Cramer, Hammer or Seed and are suitable for making slides either by contact or reduction.

For all view and landscape work the average kodak with film attachment gives perhaps the most universal satisfaction. For interior work, such as copying and scientific work, an ordinary camera, strongly constructed and provided with a good lens (Goerz, Zeis, Cooke, etc.) is indi-

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cated. For daylight work, solar paper is best adapted, while for night work, velox paper is to be used.

Photographic Blue Print Paper.

The ordinary photographic blueprint paper is made as follows. Two solutions are prepared:

SOLUTION 1.

Potassium ferricyanide.....10 parts
Distilled water.....32 parts

SOLUTION 2.

Iron ammonium citrate.....15 parts
Distilled water.....32 parts

Mix when wanted for use. Filter and apply to the surface of the paper by means of a brush or a piece of cotton wool. Let the paper dry in a dark place and store away from the light. No developer is required for this paper. After exposure it is placed in water to wash out the undecomposed iron salts. It may be improved by immersion in diluted hydrochloric acid, after which it must be again thoroughly washed in water.

Varnish for Celluloid Negatives.

Shellac, pale orange..... 4 parts
Methyl alcohol..... 6 parts
Dissolve and add:
Water of ammonia..... 6 parts
Boiling water..... 8 parts
Glycerine .....¼ part

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Allow to stand for a week and filter. After the negative is fixed and washed it is thoroughly drained. The varnish is then poured into a dish and the negative immersed and allowed to soak for a few minutes. It is then taken out and pinned by one corner to the edge of a shelf or another convenient article to dry.

Transparent Cement for Photographs.

Tragacanth, powdered	1 part
Gum arabic, best selected	4 parts
Glycerin	4 parts
Water, distilled	32 parts

Dissolve the tragacanth in one-half of the water, the gum arabic in the remainder and mix the solutions, completing by adding the glycerine. If the gum arabic is not first class you may have to filter the solution through absorbant cotton. The white of a fresh egg dissolved in a little distilled water is also an excellent medium for attaching photographic prints to glass, face foremost.

Photographing Burnt Manuscripts.

The writing on a burnt manuscript can be rendered legible by photography, provided, of course, that the paper has not completely fallen to pieces. The method of procedure is as follows: The fragments are carefully arranged on a plate of glass, then coated with a drying varnish and covered with another sheet, the whole arrangement being then placed in a printing frame. If vegetable inks have been used, clear and legible photographs are obtained by the use of orthochromatic plates and the proper color screens. Writing done in aniline or iron is photo-

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

graphed in the usual way. If the writing is in pencil, the camera and the object must be so arranged that the light reflected from the graphite may enter the lens.

To Transfer Photographs, Engravings, Etc., from Paper to Glass in Lines of Silver.

Lightly silver a sheet of glass by any of the numerous processes in use (see page XX). Then float on the silvered surface a very thin coating of Syrian asphaltum (obtainable from any dealer in photographic supplies) dissolved in benzol. This should be done in very subdued light, best of all in the dark. When the asphaltum is dry, lay on it the picture to be transferred and expose the whole to the sunlight for several hours. The asphalt, by its peculiar property, is thus rendered insoluble in direct proportion to the quantity of light received and, as a consequence, the parts protected by the lines of the picture are left soluble, while the other parts become insoluble. After exposure, the plate is placed in benzol and the soluble parts of asphaltum dissolved away. It is then rinsed and put in nitric acid for a moment, which dissolves the silver thus exposed. Rinsing in water completes the operation.

Paste for Mounting Photographic Prints.

I.

Nelson's photographic gelatin.....	4 parts
Glycerin	1 part
Alcohol	5 parts
Water	16 parts

Dissolve the gelatin in water, add the glycerine and finally the alcohol.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Arrowroot	10 parts
Gelatin	1 part
Alcohol	10 parts
Water	100 parts

Make the arrowroot into a paste with a portion of the water and soak the gelatin in the balance until soft. Mix the two and bring to a boil and boil for five minutes. On cooling, add the alcohol and sufficient liquid phenol (about 1 percent) to prevent decomposition.

3

White dextrin	2 parts
Alcohol	1 part
Boiling water	6 parts

Dissolve the dextrin in the water and when nearly cold add the alcohol.

4

In mounting by the "dry method" the paper or a part of it is previously varnished and the print having been put in place, is subjected to heat in a press. This softens the resins in the varnish and makes perfect contract between the print and the mount. The resinified paper is made by brushing fine tissue paper with the following solution:

White shellac	30 parts
Gum elemi	3 parts
Canada balsam	5 parts
Alcohol	1,000 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Making of Hand Lantern Slides for Immediate Use.

(After Dr. G. V. Black.)

The materials necessary for this work are: Hard rolled, fine, tissue tracing paper.

Ordinary cover glasses for lantern slides (thin, white glass is preferable).

Hard pencils No. H. B. and H. BBB., charcoal and paper points.

India ink and "crowquill" pens.

Water colors and fine hair pencils.

Xylol and Canada balsam.

The India ink should be diluted with water proportionately so as to make five different grades. The weak solution is used for making a very light shade, the others grading blacker. All water colors can be used freely with the exception of yellow. The latter must be used very carefully, as it will kill light badly.

The picture is made by copying or tracing on the tracing paper with pencils, ink or water colors. Dr. Black described in the following the details of making colored slides: This drawing is of a lower bicuspid tooth in which I noticed a very peculiar pulp chamber. In order to bring this out a little plainer I will use a lead pencil with which to outline the pulp chamber, doing this very lightly, and then I will color it lightly with red. I will outline the enamel also with a lead pencil, rather lightly, and go over it lightly with a pencil so as to make the enamel stand out a little from the dentine, showing it to be different; then I will take the red ink and my brush, making sure that the latter is not very wet, and lightly color the pulp chamber. It is best to do any such coloring last. It is not necessary to the drawing particularly that we color the pulp

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

chamber, but a fresh tint catches the eye. We must not make this paper too wet, for if we do it will all crinkle up in drying. When we use a brush with India ink the paper will be all crumpled up and not fit for use. How will we straighten it out? Let it dry to fix the ink, then lay it on water and saturate the entire paper and it will straighten out. It may then be dried beween pieces of blotting paper under a light compress, after which we can add anything further we wish. Now my picture is completed. I will make a second one of different design, a large pulp chamber in a second bicuspid, a very different form of tooth in which I will make the enamel a little bit stronger in its demarcation from the dentine by just a little shading with a pencil. This pulp chamber I will not color. I will put this on a cover glass, place on it a mat and over this with another cover glass, having the picture and the mat between two cover glasses. Around the whole I will place a couple of rubber bands. This is now ready for the screen."

To make a picture as transparent as possible, it is now dropped into xylol and left there for about five minutes. Two cover glasses are laid on blotting paper and on each is placed a small quantity of Canada balsam, the same as is used in mounting microscopic specimens, care being taken not to include any air bubbles. Remove the picture from the xylol and place it on the balsam cover as nearly to the center as possible and place a second balsam cover slide, face downward, over the picture. Press the two together lightly and carefully put a rubber band on each end so as to hold the slides firmly together. Place the slides on their edge for drying. After a few days' dry-

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ing, the edges may now be enclosed in the usual binding. All pressed out balsam must be carefully removed.

Sizing Preparation for Lantern Screens.

White glue	1 part
Zinc oxide	2 parts
Glycerin	1 part
Water	8 parts

Macerate the glue in the water, boil until dissolved and add the glycerine. Mix the zinc oxide with a small quantity of the solution until a smooth paste is obtained and add the remainder of the solution under constant stirring. Have the fabric stretched on a smooth surface and apply while hot. Leave on the stretcher until perfectly dry. One gallon of this sizing will cover a screen 10 feet square.

TO MAKE A PLASTER CAST FROM LIFE.

The face is well covered with vaseline, the eyelashes and eyebrows are well buried in wet clay (antiphlogistine is serviceable) and well covered with wet tissue paper and smaller hairs smoothened down. Mustache, whiskers, etc., are coated with clay and oiled. Rubber tubing or quills are inserted into the nostrils for respiration. If the ear is embedded, stop it up with cotton and wax. Have the patient in a recumbent position and apply the well-mixed plaster with a spatula. Just before setting bury a stout string into the plaster corresponding to the long axis of the face. When hardened, cut the plaster by pulling the string, which facilitates the ready removal of the impression. The impression must be thoroughly set before the cast is made. Soak the impression in water and paint it

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with a separating medium. The caste has to set for at least two hours before separation is undertaken.

HARD-RUBBER CORROSIONS OF THE PULP CANALS OF TEETH.

(After Dr. J. A. Brown.)

The preparation of vulcanite corrosions of the pulp canals of teeth consists of five distinct steps:

1. Remove the contents of the canals.
2. Wash out and dry the canals.
3. Pack the canals with vulcanizable rubber.
4. Invest the tooth in plaster of Paris and vulcanize.
5. Remove from the investment and corrode the tooth in an acid.

The process in detail is as follows: Make an opening into the pulp chamber of the tooth and with suitable broaches remove the contents of the canals. Wash and dry the tooth. Fill the canals with a solution of vulcanizable rubber in chloroform and keep in a warm place until the chloroform has entirely evaporated. Now pack some more rubber into the pulp chamber, force it in the canals as far as possible with warm instruments. Before investing the teeth press a small roll of rubber into the pulp chamber by means of a hot spatula. The purpose of the extra roll of rubber is to force more material in the canals by the expansion of the rubber during the process of vulcanization. The flask should be vulcanized for an hour and thirty minutes at a temperature of 320° F. When cold remove the tooth from the investment, wash in water and place in 50% hydrochloric acid, which corrodes the tooth

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

substances, leaving a hard rubber cast of the canals and pulp chamber complete.

CELLULOID CORROSIONS OF THE PULP CANALS OF TEETH.

(After Dr. G. Fischer.)

Celluloid corrosions may be made by first dehydrating the tooth, from which the pulp has been removed, in acetone. A solution of one part celluloid in eight parts of acetone is made. The tooth is placed in a perfectly dry test tube, covered with the celluloid solution and tightly corked. After the three days the cork is removed and the acetone is allowed to evaporate. The tube is again filled with celluloid solution and the acetone allowed to evaporate (without corking). This process is repeated until in about two or three weeks the tooth is completely covered with a solid mass of celluloid. The tube is broken and the tooth is cut from the celluloid with a sharp knife and placed in a 50% solution of hydrochloric acid, C. P., and kept in a warm room. In about two weeks decalcification will be completed. The celluloid corrosion is now carefully washed, dried and mounted and kept in a dry place protected from dust.

CLEANING AND BLEACHING OF BONES.

(After Dr. H. H. Lauderdale.)

A skull in the flesh or one which, though dry, has been properly roughed out and dried will always make the best specimen. Roughing out, as the natural science collector would term it, is removing the skin and the major portion of the flesh from the skull. Care should be taken when working on the underside of the skull not to injure the often long and delicate styloid, hamular and other proc-

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esses. With a flattened instrument, slightly bent at one end, remove all the brain substance possible. Place the roughed-out skull in a bucket of cold water, changing the water daily until it is no longer bloody. If it is not convenient to mascerate the skull at this time take it from the water and place it in a shady place to dry. It can then be kept as long as desired and will have little or no odor. On the collecting grounds the skulls are treated in this way and can then be shipped to any point in safety.

Roughed-out ligamentary skeletons—the skeletons of all smaller animals, reptiles and birds are of this kind—are soaked in an aqueous solution of arsenic for fifteen minutes to protect them from the ravages of insects which would otherwise destroy the ligaments by which the bones are held together when mounted. Skulls, of course, do not need this treatment. Skulls should never be buried in the soil or boiled in water to remove the flesh, as either method tends to set the blood in the bones and leave them dark and discolored. Placing them in an anthill and allowing the ants to remove the flesh will produce the same effect. Skulls exposed for a long time to the weather become dark and can rarely be whitened.

Place the bucket containing the roughed-out specimens in a warm place and in summer, which is the best time to macerate, place in a sunny location, filling the bucket as the water evaporates. In winter a covered crock in a warm, sheltered nook will do, though the maceration process will be much slower. In Milan, Italy, where large numbers of skeletons are macerated yearly, pieces of horseflesh are thrown in the maceration tubs to hasten the decomposition. The time of maceration varies, being best in summer, slower in winter; fresh skulls in this climate in the summer re-

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quiring from six to eight weeks. When the skull has macerated sufficiently, remove it from the bucket and scrub it in clean water with a stiff brush until thoroughly cleansed. A scraper is often of great service in cleaning the skull cavity.

Now take two gallons of water, bring it to the boiling point and add first two pounds of washing soda and then one pound of chloride of lime. Then, with a brush, wash the skull in this solution, commonly called Javelle water. The washing soda assists in removing the grease from the skull, while the chloride of lime bleaches the bones by means of the chlorine liberated. The length of time the skull is washed in this solution will depend on the strength of the solution and quality of the bone; strong, hard bones are not easily affected, while a delicate bone, left long in the solution, ceases to exist in its original form.

After washing the skull in Javelle water the proper length of time, rinse thoroughly in clean water to remove any of the lime which may have been deposited and which, on drying, fills the small pits of the bone, giving it an unnatural, chalky appearance. Place the skull in the sunshine, when it soon becomes white. If, after two or three days, it is not as white as desired, again wash in Javelle water. If the skull shows signs of grease place it in a glass jar containing naphtha and allow it to remain in the sunshine, the jar to be covered with a glass plate to prevent the readily volatilized liquid from vaporizing. The skulls are placed in the sunshine as the warmth assists the action of the naphtha. The time needed to properly degrease skulls depends considerably on their size, the smaller ones being degreased more rapidly than a relatively larger skull.

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For small skeletons and skulls about two months would be the average length of time required.

After removing from the naphtha again wash the bones in the Javelle solution, rinse in water and again place in the sun to bleach. In many fresh skulls the bones show little or no signs of grease and do not need this treatment, and in large skulls and skeletons a special machine is needed, which, though doing the work quicker and using a much smaller amount of naphtha, is much more likely to injure the bones.

The bones from the dissecting room, if strongly injected, seldom bleach perfectly, just why I cannot tell, the arsenic with which the subjects are injected being, no doubt, the cause. Bones of this sort often remain in maceration for a year and a half and then are very hard to clean, while fresh specimens would be fully cleaned in one-fourth of that time.

In macerating skulls great care should be taken to prevent any brass or iron getting into the water, as the brass renders the bones of a greenish hue, which, as yet, nothing has been found that will remove. The iron rusts the bones and then they must be scrubbed in hot hydrochloric acid, washed in Javelle fluid, rinsed in clean water and bleached.

PRESERVING FLUID FOR ANATOMICAL SPECIMENS.

(WICKERSHEIMER'S.)

Alum	100 parts
Sodium chloride	25 parts
Potassium nitrate	12 parts
Potassium carbonate	60 parts
Arsenous acid	10 parts
Water, boiling	1,000 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight

Filter the solution and add:

Glycerin	400 parts
Wood alcohol	100 parts

EMBALMING FLUID.

1.

Mercuric bichloride	1 part
Glycerin	16 parts
Wood alcohol	120 parts

2.

Solution of formaldehyde	16 parts
Phenol liquid	4 parts
Water	60 parts

DISINFECTANT SOLUTIONS: "FOUR CHLORIDES."

Alum	10 parts
Sodium carbonate	10 parts
Ammonium chloride	2 parts
Sodium chloride	2 parts
Zinc chloride	1 part
Hydrochloric acid, crude, a sufficient quantity.	
Water, enough to make	125 parts

Dissolve the alum in 50 parts of hot water, add the sodium carbonate which gives a precipitate of ammonium hydrate. Hydrochloric acid is now added in sufficient quantity under constant stirring until the precipitate is dissolved and converted into aluminum chloride. The other salts are dissolved in the remainder of the water and added to the first solution.

A suitable strength of the solution for ordinary disin-

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fectant purposes (rooms, clothing, etc.) is made by mixing one pint of the concentrated solution with one gallon of water.

DISINFECTING POWDER FOR STABLES, LATRINES, ETC.

Fresh slaked lime	75 parts
Plaster of Paris	30 parts
Sulphate of iron, powder	20 parts
Carbolic acid, crude	10 parts

Mix thoroughly.

To be used dry.

Disinfection of Rooms.

The room to be disinfected should have a temperature of 65° F. (18° C.) or more, and the air present must contain at least 75 percent of moisture. This humidity can be produced by placing pans of steaming hot water about the room. Drawers, closet doors, etc., should be opened and the furniture moved from the walls. Set on the floor in the middle of the room a large tin bucket, in which place a tin can of suitable capacity. Put into the can six ounces of potassium permanganate crystals and pour over them one pint of commercial formaldehyde solution. This quantity is sufficient for every thousand cubic feet of air space. The operator should leave the room at once, as large quantities of formaldehyde gas are immediately evolved. The room must be closed air tight and not opened for at least six hours. Furniture, draperies, carpets, pictures, etc., are not damaged by this method of disinfection. After the disinfection is completed the formaldehyde gas can be neutralized by ammonia, so as to render the room fit for occupation. This may be readily accomplished by placing in a

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suitable vessel two pounds of freshly burnt lime, seven pints of boiling water and three pints of strong ammonia water. After one hour's exposure to the ammonia vapors the room should be well aired.

STERILIZING FLUID FOR INSTRUMENTS.

Solution of formaldehyde	50 parts
Sodium borate	20 parts
Water, enough to make	100 parts*

A SIMPLE STERILIZER.

A large wide-mouth office preparation bottle, such as is used for dental varnish, is filled to the depth of about one and one-half inches with a clean powdered pumice stone. Saturate the powder with lysol, cresol or a similar strong antiseptic liquid, leaving a layer of the liquid covering the mixture. Push the instrument back and forth in the pumice, wash in hot water and dry.

REMEDIES FOR THE TEETH.

Tooth Ache Gum.

Beeswax	16 parts
Lard	4 parts
Oil of cloves	8 parts
Creosote	8 parts

Melt the wax and lard, when cool add the oil of cloves and the creosote and sufficient crosscut cotton to saturate it thoroughly with the mixture. Roll into small sticks, wrap in paraffin paper and place in vials.

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* N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Tooth Ache Drops.

Chloral hydrate	1 part
Menthol	1 part
Gum camphor	2 parts
Eugenol	2 parts

Rub together until a syrupy liquid is obtained.

Tooth Ache Sticks.

Beeswax	8 parts
Phenol	6 parts
Eugenol	1 part

Melt the wax and add the phenol and the eugenol. While still liquid immerse thin layers of absorbent cotton in the fluid and when sufficiently cool roll them into the shape of rods. For use snip off a little piece, warm it gently and introduce into the hollow tooth.

Tooth Ache Cement.

Gum mastic	20 parts
Oil of cloves	5 parts
Chloroform	50 parts
Gum copal, hard	10 parts
Opium powder	10 parts
Tannic acid	5 parts

Dissolve the gum mastic and copal in the chloroform and add the other ingredients. Apply on a ball of cotton.

Tooth Polish to Remove Stains.

Acid potassium tartrate	1 part
Pumice stone	1 part

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Mouth Cachou.

Orris root	250 parts
Musc	¼ part
Cumarin	1 part
Vanillin	5 parts
Oil of rose	5 parts
Oil of orange, sweet	5 parts
Oil of peppermint	5 parts
Oil of spearmint	5 parts
Oil of ylang-ylang	2 parts

Extract of licorice, enough to make a solid mass.

REMEDIES FOR THE HAIR AND SCALP.

Hair Tonic for Oily Hair.

Resorcinol	1 part
Betanaphthol	½ part
Compound tincture of cinchona	3 parts
Bay rum, enough to make	120 parts

Hair Tonic for Dry Hair.

Balsam of Peru	5 parts
Castor oil	20 parts
Alcohol	100 parts
Oil of bergamot	2 parts

Alopecia Ointment.

Pilocarpine hydrochloride	3 parts
Lanolin	350 parts
Cold cream, enough to make	1,000 parts

Apply to the scalp daily.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Eau de Quinine.

Quinine hydrochloride	4 parts
Tannic acid	10 parts
Alcohol	850 parts
Tincture of cantharides	10 parts
Glycerine	60 parts
Eau de Cologne	40 parts
Vanillin	1/10 part
Red saunders wood	½ part

Filter after a week's standing.

Depilatory Compound.

Barium sulphide	2 parts
Zinc oxide	3 parts
Corn starch	3 parts

Mix with water into a paste, spread on the hairy parts and when dry, wash off with warm water.

HAIR DYES.

1.

Solution 1.

Silver nitrate	2 parts
Distilled water	15 parts

Keep in amber-colored bottle.

Solution 2.

Copper sulphate, C. P.	0.6 parts
Distilled water	10 parts
Water of ammonium	6 parts

Add equal parts of solution 1 to 2 when needed. Apply with a soft toothbrush, comb the hair thoroughly and expose to sunlight for ten minutes.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Solution 1.

Silver nitrate	10 parts
Distilled water	240 parts
Water of ammonium	5 parts

Solution 2.

Pyrogallic acid	4 parts
Tannic acid	2 parts
Acetic acid, diluted	8 parts
Distilled water	240 parts

Mix equal parts of solutions 1 and 2 when needed and apply as above. If black stains about the skin should result from accidental contact with the dye, they may be removed with the following solution:

Potassium iodide	2 parts
Distilled water	16 parts

REMEDIES FOR THE SKIN.

Hand Cream.

Lanolin	25 parts
Glycerin	35 parts
Borax	5 parts
Oil of geranium	1 part

Greaseless Toilet Cream.

Tragacanth	2 parts
Water	125 parts
Glycerin	8 parts
Tincture of benzoin	2 parts
Borax	2 parts
White rose extract, enough to perfume.	

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Mascerate the tragacanth in the water until it is perfectly soft. Dissolve the borax in the glycerine. Mix the two solutions, add the tincture and the perfume and press through muslin.

REMEDIES FOR THE SKIN AND THE HANDS.

Skin Food.

White wax	4 parts
Spermaceti	4 parts
Cocoanut oil	8 parts
Lanolin	8 parts
Oil of sweet almonds	16 parts

Melt together in a porcelain capsule, remove from fire and add:

Orange flower water	8 parts
Tincture of benzoin	¼ part

Briskly beat until a perfect cream is obtained.

Skin Lotion.

Borax	16 parts
Potassium carbonate	2 parts
Dissolve in	
Hot water	80 parts
and add	
Glycerin	16 parts
Eau de Cologne	16 parts
Tincture of benzoin	4 parts
Essence of violet	4 parts

Rose water, enough to make 125 parts.

A teaspoonful to be added to a basin of warm water.

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Almond Meal Compound.

Almond meal	25 parts
Orris root, powdered	5 parts
Borax	3 parts
Castile soap powder	2 parts

Eau de Cologne.

Oil of bergamot	26 parts
Oil of lemon	28 parts
Oil of orange, sweet	22 parts
Oil of lavender	15 parts
Oil of petis grain	3 parts
Oil of orange flowers	2 parts
Alcohol	4,500 parts
Rose water	500 parts

Bay Rum.

Oil of cloves	1 part
Oil of bay	16 parts
Alcohol	1,000 parts
Water	750 parts

Dusting Powder.

1.

Salicyclic acid	10 parts
Corn starch	30 parts
Talc	300 parts

2.

Sodium perborate	3 parts
Boric acid	5 parts
Talc	90 parts
Essence of violet	2 parts

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Fingernail Bleach.

Sodium perborate..... 2 parts
Corn starch..... 2 parts

Make into a paste with water and apply to the nails. After drying wash off with warm water and polish with putty powder.

Hand-Cleansing Pastes.

1.

Extract of quillaya..... 2 parts
Borax .....1 part
Fuller's earth..... 1 part
Soft soap..... 1 part
Perfume.....q. s.

Triturate the borax with the extract of quillaya and afterward with Fuller's earth; then incorporate with the soft soap and sufficient water to form a paste. Lastly perfume as desired.

2.

Domestic soap, dried and rasped.....750 parts
Sodium carbonate, crystallized..... 20 parts
Hot water.....120 parts
Heat upon the water-bath until soft; thoroughly mix.

Then add

Pulverized pumice stone.....200 parts
Pulverized talc..... 50 parts
Perfume .....q. s.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight

Shaving Cream for Collapsible Tubes.

Curd soap	8 parts
Spermaceti	½ part
Oil of Almonds	2 parts
Glycerin	1 part
Potassium carbonate	¼ part
Water	16 parts

Cut the soap into shreds and dissolve on a water bath in 14 parts of water. Dissolve the spermaceti in the almoid oil and while warm mix it with the glycerin, potassium carbonate and remainder of the water. Transfer to a warm mortar, gradually incorporate the warm soap solution and continue to stir until a smooth paste is obtained. With this incorporate any suitable perfume.

SOAP POWDER CLEANSERS.

1.

Borax Soap Powder.

Soap	5 parts
Sodium hydroxide	3 parts
Sodium silicate	2 parts
Sodium borate	1 part

2.

Soap	6 parts
Sodium hydroxide	2 parts
Pearlash	1 part
Sodium sulphate	1 part

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3.

Dry Soap Powder.

Desiccated hard soap	28 parts
Sodium carbonate (crystals)	68 parts
Anhydrous boric acid	1 part
Boron nitride	1 part
Ammonium chloride	1 part

TO BLEACH LEATHER, IVORY, BONE AND HORN.

Digest the material with benzine at 100° F. for one hour. Pour off the liquid and drive off the residual benzine by warming the leather, etc., in a water bath and treat afterwards with liquid sulphurous acid, Javelle's water or hydrogen peroxide with ammonia water. This process produces excellent results, leaving the leather, etc., a pinkish white, suitable for the finest hand ornamentation, book covers, etc. Whatever iron is present is in the shape of an oleate or tannate, both of which are soluble in benzine. In ivory, horn and bone bleaching two birds may be killed with one stone by shaking up the benzine with hydrogen peroxide, whereby the peroxide goes over into the benzine. A separation funnel separates the benzine from the water in which the hydrogen peroxide was at first dissolved and leaves the oxygenated benzine for the treatment of the object to be bleached, which is simply immersed in it.

SILVERING OF MIRRORS.

Solution 1.

Silver nitrate	15 parts
Rochelle salt	15 parts
Distilled water	4,000 parts
Boil for six to eight minutes	4,000 parts

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Solution 2.

Silver nitrate..... 20 parts
Distilled water.....1,000 parts

Stir with a glass rod until dissolved and add

Water of ammonia, a sufficient quantity (usually a few drops only) until solution becomes perfectly clear. Now add

Silver nitrate..... 15 parts

Stir until dissolved and add

Distilled water.....3,000 parts

Filter the solution through paper (glass funnel). Keep the solution in amber-colored, glass-stoppered bottles.

Directions for silvering: Clean the glass with water of ammonia and running water. Place equal parts of solution 1 and 2 into a graduate, stir well and quickly pour on the middle of the glass to be silvered. The solution will spread over the flat surface of the glass. Leave it until the solution has precipitated, remove, place on edge for drying and when perfectly dry, coat with a thin layer of asphalt varnish.

PREVENTING CONDENSATION ON MIRRORS, EYE-GLASSES, ETC.

1.

Beeswax ..... 6 parts
Japan wax..... 3 parts
Paraffin ..... 1 part
Glycerin ..... 5 parts

The waxes and the paraffin are melted together and poured upon a heated plate or saucer containing the glycerin. It is immediately thoroughly spatulated together and put

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in a tin box. The wax combination may be replaced by common candle wax. The mixture is rubbed over the glass and polished with a soft cloth.

2.

Potassium oleate	16 parts
Glycerin	8 parts
Oil of turpentine	1 part

German green soap may be used instead of potassium oleate. Melt the oleate and glycerin together on a water bath, then add the turpentine. Should the paste be too thick, it may be thinned by the addition of more glycerin.

To Prevent a Mouth-Mirror from being Scratched by a Stone in Preparing Teeth for Crown-Work.

Place a moistened microscope cover glass upon the mouth mirror. If the stone should mar it, it can easily be replaced, thus saving your mouth mirror many a scratch.

FROSTING FOR WINDOW GLASS.

Zinc sulphate	3 parts
Magnesium sulphate	5 parts
Dextrine	2 parts
Water	202 parts

Dissolve and apply with a soft brush.

INKS.

Hectograph Compound.

Gelatin	22½ parts
Water	40 parts

Mix and set aside for ½ hour, add

Glycerin	70 parts

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Place on a steam bath, heat until dissolved and evaporate until the whole mass weighs.....100 parts

Ink for Hectograph.

Resorcin blue..... 10 parts
Distilled water..... 85 parts
Acetic acid..... 1 part

Indelible Ink.

Extract of logwood..... 20 parts
Boiling water.....280 parts
After solution has been effected mix with a liquid composed of a solution of

Potassium bichromate.....3.5 parts
Hot water.....20 parts
Hydrochloric acid..... 8 parts

Ink for Marking Linen.

1.

Silver nitrate..... 5 parts
Ammonia water..... 10 parts

2.

Sodium carbonate..... 7 parts
Gum arabic..... 5 parts
Distilled water..... 12 parts

Add solution 1 to 2 and keep in well-corked bottles, protected from light. Mark linen with a new steel or quill pen.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Glass Lettering Ink.

Zinc oxide..... 1 part
Liquid silex..... 10 parts
Mix and apply with a brush.

Pencils for Writing on Glass.

Black—Lampblack, 1; yellow wax, 4; tallow, 1. White—White lead, 4; yellow wax, 2; tallow, 1. Light Blue—Turnbull's blue, 3; yellow wax, 4; tallow, 2. Dark Blue—Prussian blue, 3; mucilage, 1; tallow, 2. Red—Vermillion, 1; yellow wax, 2; tallow, 1. Yellow—Chrome yellow, 1; yellow wax, 2; tallow, 2. Melt the wax and tallow and rub in the colors. On the large scale the pencils are molded by hydraulic pressure, then dried to the desired consistency and put in wooden carriers.

DURABLE BLACK STAIN FOR LABORATORY TABLES.

Solution 1.

Copper sulphate.....125 parts
Potassium chlorate.....125 parts
Water .....1000 parts

Solution 2.

Aniline hydrochloride..... 75 parts
Water .....500 parts

Aniline Hydrochloride.

Aniline oil..... 60 parts
Hydrochloric acid..... 60 parts
Water .....500 parts

The table must be in natural wood without paint or varnish. Two coats of the first solution are applied hot

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and allowed to dry. Two coats of the second solution are applied at an interval of one day. A coat of raw linseed oil is then applied on the dry surface and thoroughly rubbed in. Finally, the table is washed with hot soap suds.

BATTERY FLUIDS.

A. For the Carbon and Zinc Battery.

1. For Ordinary Use.

Sodium bichromate.....4 troy ounces
Sulphuric acid, com'l.....4 troy ounces
Water, cold.....32 fl. ounces

2. For Use With the Galvano-Cautery.

Sodium bichromate.....4¼ troy ounces
Sulphuric acid, com'l.....9½ fl. ounces
Water, cold.....32 fl. ounces

3. For Medical Batteries.

Potassium bichromate, powdered..7½ troy ounces
Sulphuric acid, com'l.....8 fl. ounces
Water .....5 pints

Add the acid in a thin stream, under constant stirring, to the water and dissolve the powdered potassium bichromate in the mixture.

B. For the Leclanché Battery.

Ammonium chloride.....10½ troy ounces
Water, enough to make.....32 fl. ounces

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OIL STONE LUBRICANT.

1.

Glycerin ..... 1 part
Alcohol ..... 2 parts

2.

Neatsfoot oil ..... 1 part
Fresh lead shavings, a sufficient quantity.

Place in bottle and expose to sunlight for some weeks.

To Clean Oil Stoves.

Wash the surface with alcohol and even the surface with the finest sand paper.

Paste for Razor Strops.

Pumice stone, very fine powder ..... 30 parts
Emery flour ..... 30 parts
Paris red ..... 15 parts
Lard ..... 30 parts
Curd soap ..... 30 parts

Lubricant for Syringe Pistons, Sounds, Etc.

Gum tragacanth ..... 25 parts
Glycerin ..... 10 parts
Phenol solution, 2% ..... 90 parts

Lubricant for Surgeon's Rubber Gloves.

Gum tragacanth ..... 8 parts
Boric acid ..... 4 parts
Solution of formaldehyde ..... 1 part
Alcohol ..... 32 parts
Water ..... 200 parts
Oil of rose geranium, a sufficient quantity to scent.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Dissolve the gum tragacanth in the water, in which the boric acid has previously been dissolved. Dissolve the oil in the alcohol, add the solution of formaldehyde and mix with the gum solution. Keep in well stoppered wide-mouth bottles.

A SUBSTITUTE FOR RUBBER GLOVES.

Celloidin, Schering..... 1 part
Alcohol, 96%..... 5 parts
Castor oil..... ¼ part

The hands are thoroughly cleansed with soap and hot water, dried, washed in alcohol and again dried. The above solution is now painted on the hands. It leaves an elastic coat. Washing in alcohol will remove it.

LIQUID SPLINT FOR THE FIXATION OF FRACTURES.

Powdered starch..... 2 parts
Gelatin ..... 2 parts
Solution of potassium silicate..... 60 parts
Boric acid..... 1 part

Mix the starch with the solution of silicate of potash by shaking from a pepper-box and stirring constantly until mixed. Dissolve the gelatin in 10 parts of warm water and add the solution to the mixture. Put into a jug of double the capacity and ferment at room or sun temperature for three or four days. Then add the boric acid, mix well, and it is ready for use.

If too thick after standing, thin it with boiling water. Keep corked. Apply a silk stocking or roller bandage; then a coat of the preparation with a brush, and repeat until three or four layers are applied or until the splint is thick enough. It may be cut after hardening and eyelets and laces put in.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

TO CLEAN MARBLE SLABS.

Grease spots are removed by a thick mixture of magnesia and gasoline spread over the surface, say three-eighths of an inch thick. Let it remain on the stone an hour or two, then remove the dried crust of magnesia. Stains from extracts may be removed by a thick paste of talcum, white lead, lemon juice and either citric, tartaric or oxalic acid, thinned with alcohol. If this fails, try a mixture of barium hyperoxide and dilute sulphuric acid, mixed at the lowest available temperature and avoiding any excess of acid. Use as in the case of the magnesia mixture above spoken of. The stone will have to be repolished, using a mixture of "putty" and paraffin oil.

Kid Gloves Cleanser.

Stearic acid..... 5 parts
Carbon tetrachloride.....75 parts
Water of ammonia.....20 parts

Shake before using.

Straw Hat Cleanser.

Sodium bisulphate.....10 parts
Tartaric acid..... 2 parts
Borax .....10 parts

Moisten a small quantity of the powder with water and apply this mixture with a wet brush.

To Clean Saliva Ejector Tubes.

Place in 10% hydrochloric acid for a few hours and wash in running water.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

To Remove Glaze from Carborundum Stones.

To renew carborundum stones that have become glazed from grinding down teeth containing amalgam fillings, place them in a beaker and cover with a 50% solution of nitric acid, allowing them to remain for two or three hours. Remove and place in a strong solution of sodium bicarbonate for several hours, that the acid which has been absorbed by the stones may be neutralized.

To Clean Vulcanite Files.

When a vulcanite file becomes clogged with rubber and plaster, it may easily be cleansed by wrapping absorbent cotton around it and saturating the cotton with chloroform. In about ten minutes it can be cleaned perfectly by the use of a stiff brush wheel on the lathe.

FREEZING PREVENTIVES FOR AUTOMOBILES.

1.

Potassium carbonate	75 parts
Glycerin	50 parts
Water	100 parts

2.

Calcium chloride	4½ parts
Water, hot	8 parts

3.

Wood alcohol	2 parts
Glycerin	4 parts
Water	6 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

4.

(For acetylene generators.)

Calcium chloride.....2 parts
Water .....8 parts

Freezing Mixtures.

1.

Potassium nitrate..... 10 parts
Ammonium chloride..... 30 parts
Potassium chloride..... 60 parts
Water .....100 parts

2.

Ammonium chloride.....10 parts
Potassium nitrate..... 3 parts
Potassium chlorate.....20 parts
Cold water.....32 parts

Mix the salt and add to the water. Will reduce the temperature of the water about 50° F.

FIRE EXTINGUISHERS.

Powders.

1.

Sodium chloride.....43 parts
Alum .....20 parts
Sodium phosphate..... 5 parts
Sodium carbonate.....3½ parts
Sodium silicate.....20 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

2.

Sodium bicarbonate..... 40 parts
Sodium sulphate..... 60 parts
Ammonium chloride.....100 parts

3.

Potassium nitrate.....59 parts
Sublimated sulphur.....36 parts
Charcoal powder..... 4 parts
English red..... 1 part

Place in a round paper carton, holding about five pounds. Punch a hole in the center and push one end of a fuse cord (about four inches) into the mixture, leaving the other end (about six inches) extend on the outside. In case of fire, the mixture is set on fire by the fuse cord. The burning of the mixture uses up the oxygen in the air and thus extinguishes the flames. To be used in closed rooms only.

Liquid.

Calcium chloride, crude.....20 parts
Sodium chloride, crude..... 5 parts
Water .....75 parts
To be used with a hand spray in case of fire.

Fire-proofing of Paper.

Ammonium sulphate.....4 parts
Sodium borate.....1 part
Boric acid.....1½ parts
Water .....4 parts

The paper is immersed in the hot solution until completely saturated and dried.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Fire-proofing of Wood.

Lime, fresh slaked.....40 parts
Sodium chloride.....10 parts
Alum .....10 parts
Solution of sodium silicate.....10 parts
Sodium wolframate.....10 parts

Mix.

Fire-proofing of Textile Materials.

Ammonium sulphate..... 8 parts
Ammonium carbonate.....2.5 parts
Boric acid..... 3 parts
Borax ..... 2 parts
Starch ..... 2 parts
Water .....100 parts

Water-proofing of Paper.

Gelatin .....1 part
Water .....4 parts
Glycerin .....1 part

Cover the paper on both sides with the warmed solution; after a few minutes, before it is fully dry, drop into the following solution:

Formaldehyde solution..... 75 parts
Water .....500 parts

Water-proofing of Wrapping Paper.

Alum ..... 24 parts
Hard soap..... 4 parts
White wax..... 15 parts
Water .....120 parts

Boil together. Saturate the paper with the hot mixture and hang up to dry.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Water-proofing of Boots.

Heat fish oil, castor oil or tallow to about 250° F. over a naked fire, and then add about one-fifth of the weight of the oil taken of either vulcanized or raw India rubber, stirring well until the latter is dissolved. To color, a little printer's ink may be used. One or two applications of this are sufficient to thoroughly waterproof a pair of boots for a season. Boots thus treated will take a common shoe blacking afterwards with ease.

Impervious Corks.

The usual procedure for treatment with paraffin is to immerse the dry corks in the melted substance; they should be kept in the bath for some time and sunk by a porous disc of some kind. Corks treated in this way should be quite impervious to glycerin.

Stoppers for Chemicals.

Suitable corks are saturated in a solution heated to 100° F. composed of

Gelatin	15 parts
Glycerin	25 parts
Water	500 parts

If corks are used for acids, they should be additionally treated with

Paraffin	10 parts
Petrolatum	2 parts

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Sealing Wax for Bottles.

Rosin	480 parts
Japan wax	60 parts
Turpentine	30 parts

Melt together in a water-bath.

To color above quantity, add

For green color: verdigris	45 parts
For red color: cinnabar	45 parts
For blue color: Prussian blue	100 parts
For yellow color: chrome yellow	40 parts

To remove a tightly wedged glass stopper from the neck of a bottle:

Gently heat the neck of the bottle and remove the stopper while the neck is still warm and before the stopper becomes affected by the heat.

Engine Burs—How to Sharpen.

According to Dr. Elliott, a suitable disc mounted in the engine, preferably an electric engine, and a watchmaker's eye glass form all the equipment necessary. After an experience of some years using vulcanite and corundum, shellac and corundum, Arkansas stone, copper disks fed with carborundum and vaseline, none compare with what is called the ruby gem disk, made in Worcester, Mass. The time actually taken to sharpen a bur is less than half a minute, and you can sharpen all the burs you have used in a day and make them absolutely sharp in five or ten minutes. The disk is about one inch in diameter, thin and cone-shaped, the base of the cone toward the hand piece. These disks can be readily turned and given the proper angle at the edge, by holding against the rapidly revolving disk a coarse carborundum wheel or broken bit. Another excellent

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

plan is to use a steel disk, the teeth formed by rubbing on a very fine file and then hardening. This gives a sharper, cleaner blade to the bur than the ruby gem, but has the disadvantage that the bur to be sharpened must be soft, have the temper drawn, while this is not necessary with the stone disk. The bur is held between the thumb and index finger of the left hand and slowly rotated as each blade is gone over by the rotating disk held in the right hand. Make it a rule to never use a bur the second time wthout sharpening.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

CHAPTER X.

TABLES.

WEIGHTS AND MEASURES.

The system of weights and measures as used in the United States was standardized in 1836, when the then Secretary of the Treasury was authorized by Congress to furnish each state of the Union with a complete set of revised standards for weights, liquid measures, and measures of length. These various methods of weights and measures are quite confusing when an examination of their comparative units is made—that is, it is perplexing to find that a pound is not a pint, an ounce does not equal a fluidounce, and a drop is neither a grain nor a minim.

The United States National Prototype Standards, from which all weights and measures now used in this country are derived, are the meter and the kilogram, and they are preserved in the custody of the National Bureau of Standards at Washington. The United States meter and kilogram are identical with the international Standards of the same capacity.

The United States standards of weights and measures are:

The apothecaries' or troy ounce	= 480 grains.
The commercial or avoirdupois ounce	= 437.5 grains.
The apothecaries' fluidounce (identical with the fluidounce of the liquid gallon)	= 480 minims.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

The weights and measures used in the British Pharmacopeia are the Imperial weights and measures, legal for commercial purposes in the British Empire. The English apothecaries' weights are the same as those used in the United States.

Apothecaries' Weight.

Pound.		Troy ounces.		Drams.		Scruples.		Troy grains.
℔ 1	=	12	=	96	=	288	=	5760
		℥ 1	=	8	=	24	=	480
				ʒ 1	=	3	=	60
						℈ 1	=	gr. 20

Troy Weight.

Pound		Troy ounces.		Pennyweights.		Troy grains.
℔ 1	=	12	=	240	=	5760
		℥ 1	=	20	=	480
4 troy grains = 7 carat.				dwt. 1	=	gr. 24

Avoirdupois Weight.

Pound.		Ounces.		Drams.		Troy grains.
℔ 1	=	16	=	256	=	7000.
		oz. 1	=	16	=	437.5
				dr. 1	=	gr. 27.34375

Relative Value of Troy and Avoirdupois Pounds.

1 troy pound	=	0.822857 avoirdupois pound.
1 avoirdupois pound	=	1.215277 troy pounds.

Apothecaries' or Wine Measure (United States).

Gallon.		Pints.		Fluidounces.		Fluidrams.		Minims.		Cubic inches.
Cong. 1	=	8	=	128	=	1024	=	61440	=	231
		O 1	=	16	=	128	=	7680	=	28.875
				fl℥ 1	=	8	=	480	=	1.8047
						fl℥ 1	=	♏ 60	=	.2256

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Liquid Measure.

1 pint	=	4 gills.		1 gallon	=	4 quarts.	
1 gill	=	4 fluidounces.		1 quart	=	2 pints.	

Imperial Measure (British Pharmacopeia).

Gallon.		Pints.		Fluidounces.		Fluidrams.		Minims.
1	=	8	=	160	=	1280	=	76800
		1	=	20	=	160	=	9600
				1	=	8	=	480
						1	=	60

The Metric System.

The metric or decimal system of weights and measures originated with Prince de Talleyrand, bishop of Autun, in 1790. Its almost universal adoption by civilized nations, its legality (though not compulsion) in England and the United States,* and its adoption by the United States Pharmacopeia of 1890 demand that it should be understood by the progressive practicing physician. Except in the English-speaking world, it is the only system of weights and measures used for governmental, statistical, and scientific purposes. It is based upon the decimal system—that is, the denominations increase by tens and decrease by tenths. The starting point is the unit of linear measures, the *meter,* which represents one-ten-millionth of the polar quadrant of the earth—that is, the distance from the equator to the poles—and is equivalent to 39.37 English inches. The *gram* (Gm.) is the unit of weight; the *liter,* or capacity (although the *cubic centimeter* is oftener preferably used); the *are,* of surface measure. The denominations

*The metric system was legalized in Great Britain in 1864, and in the United States by act of Congress in 1866.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

representing the subdivisions of any unit are expressed by prefixing the Latin numerals, *deci, centi,* and *milli* to the unit—meaning respectively one-tenth, one-hundredth, and one-thousandth; the multiples are expressed by prefixing the Greek numerals *deka, hecto, kilo* and *myria*—meaning ten, hundred, thousand, and ten thousand.

The gram is derived as follows: The meter is divided into one hundred equal parts, called *centimeters.* On one centimeter as a base a cube is erected, having for its three dimensions one centimeter (Cm.) each. The contents of this cube will be one cubic centimeter (Cc.), measuring one milliliter. This quantity of distilled water at its maximum density (39.2° F., 4° C.) and 30 inches barometric pressure weighs one gram, or 15.432 grains.

The liter is derived as follows: The meter is divided into ten equal parts, called *decimeters.* On one decimeter as a base a cube is erected, having for its three dimensions one decimeter (dm.) each. The contents of this cube will be one cubic decimeter ($dm.^3$), the capacity of which is one liter, equivalent to 1,000 cubic centimeters, or 33.81 fluidounces, or 2.113 pints. One liter of distilled water at 4° C. and 30 inches barometric pressure weighs 1,000 grams, or 1 kilogram, or 2.2 pounds avoirdupois, or 15,432 grains.

Metric Weights and Measures.

The meter, or unit of length,	=	39.37043 inches.
The liter, or unit of capacity,	=	33.814 fluidounces (U. S.).
The gram, or unit of weight,	=	15.432348 troy grains.

Measures of Length.

	English inches.		English inches.
Millimeter (mm.)	= .03937	Decimeter (dm.)	= 3.93704
Centimeter (cm.)	= .39370	Meter (m.)	= 39.37043
Kilometer	= 39.370.43 English inches.		

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Measures of Capacity.

	English cubic inches.		English cubic inches.
Milliliter (Cc.)	= .06102	Deciliter (dl.)	= 6.10280
Centiliter (cl.)	= .61028	Liter (L.)	= 61.02800

Hectoliter = 6102.8 English cubic inches.

Measures of Weight.

	Troy grains.		Troy grains.
Milligram (mg.)	= .0154	Decigram (dg.)	= 1.5432
Centigram (cg.)	= .1543	Gram (Gm.)	= 15.4324

Kilogram = 15432.34 troy grains.

Apothecaries' Weight and Metric Equivalents.

1/100 grain	= 0.0006 grams.	15 grains	= 0.97 grams.
1/64 "	= 0.001 "	15.4 "	= 1. "
1/50 "	= 0.0013 "	20 "	= 1.3 "
1/40 "	= 0.0016 "	24 "	= 1.55 "
1/32 "	= 0.002 "	30 "	= 1.94 "
1/20 "	= 0.003 "	40 "	= 2.6 "
1/16 "	= 0.004 "	45 "	= 2.92 "
1/12 "	= 0.005 "	50 "	= 3.23 "
1/10 "	= 0.006 "	60 " (1 dram)	
1/8 "	= 0.008 "		= 3.89 "
1/6 "	= 0.011 "	1½ drams	= 5.58 "
1/5 "	= 0.012 "	1¾ "	= 6.81 "
1/4 "	= 0.015 "	2 "	= 7.78 "
1/3 "	= 0.022 "	2½	= 9.72 "
½ "	= 0.032 "	3 "	= 11.65 "
¾ "	= 0.048 "	4 "	= 15.55 "
1 "	= 0.065 "	5 "	= 19.43 "
2 grains	= 0.13 "	6 "	= 23.3 "
3 "	= 0.2 "	1 ounce (480 grains)	
4 "	= 0.26 "		= 31.1 "
5 "	= 0.32 "	2 ounces	= 62.2 "
6 "	= 0.39 "	3 "	= 93.3 "
8 "	= 0.52 "	4 "	= 124.4 "
10 "	= 0.65 "	6 "	= 186.6 "
12 "	= 0.78 "	8 "	= 248.8 "
		10 "	= 311. "
		12 "	= 373.2 "

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Apothecaries' Measure and Metric Equivalents.

1	minim	=	0.06 Cc.	1¼	fluidrams	=	4.65 Cc
2	minims	=	0.12 "	1½	"	=	5.60 "
3	"	=	0.18 "	1¾	"	=	6.50 "
4	"	=	0.24 "	2	"	=	7.50 "
5	"	=	0.30 "	3	"	=	11.25 "
6	"	=	0.36 "	4	"	=	15.00 "
7	"	=	0.42 "	8	"		
8	"	=	0.50 "		(1 fluidoz.)	=	30.00 "
9	"	=	0.55 "		(more exactly)	=	29.57 "
10	"	=	0.60 "	2	fluidounces	=	59.15 "
15	"	=	0.92 "	3	"	=	88.72 "
20	"	=	1.25 "	4	"	=	118.29 "
25	"	=	1.54 "	8	"	=	236.59 "
30	"	=	1.90 "	16	"		
40	"	=	2.50 "		(1 pint)	=	473.18 "
45	"	=	2.80 "	32	"	=	946.36 "
50	"	=	3.10 "	128	"		
60	minims				(1 gallon)	=	3785.43 "
	(1 fluidram)	=	3.70 "				

Weight Equivalents.

To convert grains into grams multiply by..... 0.065
To convert grams into grains multiply by..... 15.5
To convert drams into grains multiply by..... 3.9
To convert ounces (avoirdupois) into grams multiply by.... 28.4
To convert pounds (avoirdupois) into grams multiply by.... 543.6

Measure Equivalents.

To convert cubic centimeters into drams multiply by..... 15.5
To convert cubic centimeters into drams multiply by..... 0.26
To convert cubic centimeters into ounces (avoirdupois) multiply by 9.03
To convert pints into cubic centimeters multiply by..... 473.
To convert liters into ounces (avoirdupois) multiply by..... 35.3
To convert gallons into liters multiply by..... 3.8

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Approximate Measures.

A drop equals roughly	1 minim.
A teaspoonful	= 1 fluidram.
A dessertspoonful	= 2 fluidrams.
A tablespoonful	= ½ fluidounce.
A wineglassful	= 2 fluidounces.
A teacupful	= 4 fluidounces.
A tumblerful	= 8 fluidounces.
A handful	= 4 ounces.

Percentage Solution Table.

Showing the quantity of drug and water to use for preparing aqueous solutions of different strengths. In these calculations 456 grains have been taken as the weight of one fluidounce of distilled water at ordinary temperature.

Fluidoz. water.	Gr. for 1-1000 percent sol'n	Gr. for 1-500 percent sol'n	Gr. for ½ percent sol'n	Gr. for 1 percent sol'n	Gr. for 2 percent sol'n	Gr. for 3 percent sol'n	Gr. for 4 percent sol'n	Gr. for 5 percent sol'n	Gr. for 10 percent sol'n	Gr. for 20 percent sol'n	Gr. for 25 percent sol'n	Gr. for 50 percent sol'n
½	0.228	0.457	1.14	2.3	4.6	7.	9.5	12	25.3	57	76	228
1	0.456	0.913	2.29	4.6	9.3	14.1	19.	24	50.6	114	152	456
2	0.912	1.83	4.58	9.2	18.6	28.2	38.	48	101.3	228	304	912
3	1.37	2.74	6.87	13.8	27.9	42.3	57.	72	151.9	342	456	1368
4	1.82	3.65	9.16	18.4	37.2	56.4	76.	96	202.6	456	608	1824
6	2.74	5.48	13.75	27.6	55.8	84.6	114.	144	303.9	684	912	2736
8	3.65	7.31	18.32	36.8	74.4	112.8	152.	192	405.2	912	1216	3648
12	5.47	10.96	27.5	55.2	111.6	169.2	228.	288	607.9	1368	1824	5472
16	7.3	14.6	36.64	73.6	148.8	225.6	304.	384	810.4	1824	2430	7296

Short Rules for Determining Percentages in Mixtures.

Multiply 480 by the percentage desired and point off two right-hand figures. The figures at the left of separatrix will give the number of grains or drops, 480 being the number of grains to the ounce. Examples: $480\times4=1920$; $19.20=19\frac{1}{5}$; $19\frac{1}{5}$ grains to an ounce of liquid, a 4 per cent solution.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Cabalistic Signs Used in Prescription Writing.

℔	libra	a pound
℥	uncia	an ounce
ʒ	drachma	a drachm
℈	scrupulus	a scruple
gr.	granum	a grain
C	congius	a gallon
O	octarius	a pint
f℥	fluid uncia	a fluid ounce
fʒ	fluid drachma	a fluid drachm
♏	minim	a drop
gtt	gutta	a drop
ss	semis	half

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Table of Solubility.

Name	Water	Alcohol	Ether	Glycerin
Acetanilid	230	3.5	readily	.....
Acid arsenic	80	.....	.....	5
Acid benzoic	400	3	3.5	10
Acid boric	25	15	.....	10
Acid carbolic	15	readily	readily	readily
Acid citric	1	1	50	readily
Acid salicylic	500	readily	readily	.....
Acid tannic	1	2	.....	2
Acid tartaric	1	2.5	.....	readily
Acid trichloracetic	readily	readily	readily	.....
Alum	12	.....	.....	3
Ammonium bromid	1.3	.....	.....	.....
Ammonium carbonate	4	.....	.....	.....
Ammonium chlorid	3	.....	.....	5
Antipyrin	1	1	50	.....
Apomorphin hydrochlorid	35	35	.....	.....
Atropin sulphate	1	10	.....	readily
Borax	17	.....	.....	.....
Camphor	.....	readily	readily	.....
Caffein	80	50	300	.....
Chloral hydrate	readily	readily	readily	readily
Cocain hydrochlorid	0.5	4	.....	.....
Codein phosphate	4	difficult	.....	.....
Copper sulphate	4	.....	.....	4
Iodin	5000	10	3	.....
Iodoform	.....	50	6	.....
Iodol	5000	3	15	.....
Iron sulphate	2	.....	.....	4
Lithium carbonate	80	.....	.....	.....
Magnesium sulphate	1	.....	.....	.....
Menthol	difficult	readily	readily	.....
Mercuric chlorid	16	3	4	15
Morphin hydrochlorid	25	50	.....	5
Morphin sulphate	20	.....	.....	5
Phenacetin	1400	16	.....	.....

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Name	Water	Alcohol	Ether	Glycerin
Pilocarpin hydrochlorid	10	readily	.....	.....
Potassium acetate	0.5	2	.....	.....
Potassium bicarbonate	4	.....	.....	readily
Potassium bromid	2	200	.....	4
Potassium carbonate	1	.....	.....	15
Potassium chlorate	16	130	.....	32
Potassium iodid	1	12	.....	2.5
Potassium permanganate	21	.....	.....	explosive
Potassium sulphate	10	.....	.....	.....
Potassium tartrate	1	.....	.....	.....
Quinin hydrochlorid	34	3	.....	.....
Quinin sulphate	800	90	.....	.....
Resorcinol	1	0.5	0.5	5
Saccharin	250	25	.....	.....
Salol	.....	10	0.3	.....
Silver nitrate	0.6	10	.....	readily
Sodium acetate	3	30	.....	15
Sodium benzoate	2	.....	.....	13
Sodium bicarbonate	12	.....	.....	4
Sodium bromid	1.2	5	.....	1
Sodium carbonate	2	.....	.....	5
Sodium chlorid	3	.....	.....	difficult
Sodium phosphate	6	.....	.....	difficult
Sodium salicylate	1	6	.....	readily
Sodium sulphate	3	.....	.....	1
Strychnin nitrate	90	70	.....	25
Strychnin sulphate	31	65	.....	.....
Sugar	0.5	.....	.....	.....
Sugar, milk	6	.....	.....	.....
Sulphonal	500	65	135	.....
Tartar emetic	17	.....	.....	readily
Thymol	1100	1	1	.....
Veratrin	.....	4	7	100
Zinc sulphate	0.6	.....	.....	3

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Number of Drops in a Fluidram.

Table showing number of drops in a fluidram of different liquids, with weight in grains and in grams:

Name	Drops in 1 fluidram (60m)	Weight of 1 fluidram In grains	In grams
Acid. aceticum	108	58	3.75
Acid. aceticum dilut	68	55	3.56
Acid. hydrochlor	70	65	3.62
Acid. hydrochlor. dilut	60	56	3.49
Acid. lacticum	111	66	4.27
Acid. nitricum	102	77	4.98
Acid. nitricum dilut	60	58	3.62
Acid. sulphur	128	101	6.54
Acid. sulphur. aromat.	146	53	3.43
Acid. sulphur. dilut	60	58½	3.79
Æther fortior	176	39	2.52
Alcohol	146	44	2.85
Aqua	60	55	3.56
Aqua ammon. fortior	66	50	3.24
Chloreform. purificat	250	80	5.18
Creosotum	122	56½	3.66
Glycerinum	67	68	4.40
Hydrargyrum	150	760	49.24
Liq. potassi arsenitis	57	55	3.56
Oleum caryophylli	130	57	3.69
Oleum cinnamonic	126	53½	3.46
Oleum gaultheriæ	125	62	4.01
Phenol liquid	111	59	3.82
Spiritus ammon. aromat.	142	48	3.11
Syrupus	65	72	4.66
Tinctura aconiti	146	46	2.98
Tinctura digitalis	128	53	3.43
Tinctura ferri chloridi	150	53	3.43
Tinctura iodi	148	47	3.04
Tinctura opii	130	53	3.43
Tinctura Zingiberis	144	46	2.98

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Thermometric Equivalents.

To reduce Centigrade degrees to those of Fahrenheit, multiply by 9, divide by 5 and add 32; or, degrees Centigrade $\times 1.8+32$=degrees Fahrenheit.

To reduce Fahrenheit degrees to those of Centigrade, subtract 32, multiply by 5, and divide by 9; or, degrees $-32 \div 1.8$=degrees Centigrade.

Fahrenheit and Centigrade Scales.

°C	°F	°C	°F	°C	°F	°C	°F
—20	—4.	1	33.8	22	71.6	43	109.4
—19	—2.2	2	35.6	23	73.4	44	111.2
—18	—0.4	3	37.4	24	75.2	45	113.
—17	1.4	4	39.2	25	77.	46	114.8
—16	3.2	5	41.	26	78.8	47	116.6
—15	5.	6	42.8	27	80.6	48	118.4
—14	6.8	7	44.6	28	82.4	49	120.2
—13	8.6	8	46.4	29	84.2	50	122.
—12	10.4	9	48.2	30	86.	51	123.8
—11	12.2	10	50.	31	87.8	52	125.6
—10	14.	11	51.8	32	89.6	53	127.4
— 9	15.8	12	53.6	33	91.4	54	129.2
— 8	17.6	13	55.4	34	93.2	55	131.
— 7	19.4	14	57.2	35	95.	56	132.8
— 6	21.2	15	59.	36	96.8	57	134.6
— 5	23.	16	60.8	37	98.6	58	136.4
— 4	24.8	17	62.6	38	100.4	59	138.2
— 3	26.6	18	64.4	39	102.2	60	140.
— 2	28.4	19	66.2	40	104.	61	141.8
— 1	30.2	20	68.	41	105.8	62	143.6
0	32.	21	69.8	42	107.6	63	145.4

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

°C	°F	°C	°F	°C	°F	°C	°F
64	147.2.	78	172.4	92	197.6	106	222.8
65	149.	79	174.2	93	199.4	107	224.6
66	150.8	80	176.	94	201.2	108	226.4
67	152.6	81	177.8	95	203.	109	228.2
68	154.4	82	179.6	96	204.8	110	230.
69	156.2	83	181.4	97	206.6	111	231.8
70	158.	84	183.2	98	208.4	112	233.6
71	159.8	85	185.	99	210.2	113	235.4
72	161.6	86	186.8	100	212.	114	237.2
73	163.4	87	188.6	101	213.8	115	239.
74	165.2	88	190.4	102	215.6	116	240.8
75	167.	89	192.2	103	217.4	117	242.6
76	168.8	90	194.	104	219.2	118	244.4
77	170.6	91	195.8	105	221.	119	246.2

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

Comparison of Wire Gauges.

Number of Wire Gauges Expressed in Decimal Parts of an Inch.

Gauge Nos.	*B. & S. & A. W. Gauge	**B. W. G. Eng. Standard Stubs	Twist Drill	Gauge Nos.	*B. & S. & A. W. Gauge	**B. W. G. Eng. Standard Stubs	Twist Drill
4.0	.460	.454	.....	19	.03589	.042	.166
3.0	.40964	.425	.....	20	.03196	.035	.161
2.0	.3648	.380	.....	21	.02846	.032	.159
1.0	.32486	.340	.....	22	.02535	.028	.157
1	.2893	.300	.228	23	.02257	.025	.154
2	.25763	.284	.221	24	.0201	.022	.152
3	.22942	.259	.213	25	.0179	.020	.1495
4	.20431	.238	.209	26	.01594	.018	.147
5	.18194	.220	.2055	27	.01419	.016	.144
6	.16202	.220	.204	28	.01264	.014	.1405
7	.14428	.180	.201	29	.01126	.013	.136
8	.12840	.165	.199	30	.01002	.012	.1285
9	.11443	.148	.196	31	.00893	.010	.120
10	.10189	.134	.1935	32	.00795	.009	.116
11	.09074	.120	.191	33	.00708	.008	.113
12	.08081	.109	.189	34	.0063	.007	.111
13	.07196	.095	.185	35	.00561	.005	.110
14	.06408	.083	.182	36	.005	.004	.1065
15	.05707	.072	.180	37	.00445	....	.104
16	.05082	.065	.177	38	.00396	....	.1015
17	.04525	.058	.173	39	.00353	....	.0995
18	.0403	.049	.1695	40	.00314	....	.098

*Brown & Sharpe, or American Wire Gauge.

**Birmingham Wire Gauge.

N. B.—Parts as used in this *Dental Formulary* mean quantities by weight.

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